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Evolution of the American Plate Glass Industry

By Frank W. Preston

NEARLY all branches of the glass industry are, in this country, in a process of rapid evolution. Apart from new developments, such as the use of glass for high tension insulators and other things not envisaged till recently, the old established lines, making articles like bottles, sheet, and plate (the product itself not differing substantially from that of our grandfathers), are undergoing radical changes in method of manufacture and alignment of companies. Ten years ago, or thereabouts, plate glass was essentially a store-front article and the consumption in the United States ran around seventy million square feet per annum. It was a quarter inch thick, or a little more, and competition centered largely on the question of who could make the biggest sheets (technically known as the biggest brackets). The furnaces were all pot furnaces, and the grinding and polishing machines, having eliminated the old reciprocating rectangular decks, were all of the rotary type with circular decks and circular runners. The "transfer system" was general, though one or two plants were using movable bridges and fixed decks. (The transfer system employs fixed machines and removeable decks.) One or two of the wire glass companies had similar grinding and polishing machines though their furnaces were tanks.

The advent of the closed automobile in great numbers changed all that. An enormous demand was created for small sizes (small brackets), and the importance of the large sheet declined. Moreover, the very largest sheets ceased to be practical politics even for the store-front, as they were uninsurable. The demand for glass exceeded the supply, and premiums were paid for it. Competition among automobile manufacturers caused them to enter the glass field. Fisher Bodies, a subsidiary of General Motors, bought up the National Plate; Durant obtained control of the American Plate. Henry Ford, with characteristic energy, when he could not get glass in sufficient quantities from the glass manufacturers, developed a new process that has revolutionized the industry, but being still short of glass, also bought up the Allegheny Plate.

The new Ford process has received mention several times in The Glass Industry (1923, '24, '30). It proved ultimately so successful that glass men proper had to sit up and take notice. The Pittsburgh Plate and Standard Plate both attempted similar processes, the latter on too ambitious a scale for a first attempt. The Mississippi Wire Glass Company also put in machinery very similar to Henry Ford's. Some of the other wire glass companies discontinued their circular tables without installing new equipment.

For a time the Pittsburgh Plate was the only plate glass company, other than the Ford Motor Company, that was at all successful with the new continuous type machines, and even here the adoption of the tank system for the furnaces proved a source of great anxiety. In Europe, however, the new Bicheroux casting system, the Pilkington continuous grinding and polishing machines and similar developments paved the way for the growth of a plate glass industry using pot furnaces and continuous grinding and polishing machinery. Quite recently these ideas have been adopted by the Edward Ford Plate Glass Company and the National Plate.

One of the difficulties with the early varieties of the Bicheroux process was a certain lack of flexibility. It is not economically practicable to make glass of different thicknesses with the Bicheroux process as installed in some factories. A pot holds a given *volume* of glass: the casting tables hold a given *area* of glass, and a change of thickness involves either a modification of area or of volume, neither being simply effected. This difficulty is however largely overcome with the new types of straight roller lehr.

Those companies that did not adopt the continuous system, either of the Henry Ford—Pittsburgh Plate type or the Bicheroux—Pilkington type, were forced to adopt every economy and improvement in their circular machines. These still retained some advantages for very large sheets, for which, of course, a limited market still remains and is likely to remain.

The Springdale plant of the Standard Plate, formerly the Heidenkamp plant, after various attempts at renovation,

was soon closed down by successive reductions in the selling price of finished glass. Costly experiments of the Standard, (at Butler) and American Plate Glass companies, with new forms of casting table, in both cases proving utter failures, seem to have demonstrated that the old-fashioned pasteboard-and-rolling-pin idea of making plate glass is, as it has always appeared to be, mechanically ridiculous. Both plants have been shut down a couple of times in this connection and at the moment of writing, both are still shut down.

At this stage a new element was injected into the trouble of the industry. The demand, which had hitherto been for ¼" glass as standard, shifted very largely, so far as automobile sizes ("small brackets") were concerned, to ⅛" glass, due to the sudden popularization of "unshatterable" or "laminated" glass.

For this work the new Ford Motor Company's process was entirely suitable and in a great measure the Pittsburgh Plate's. But the old casting tables were utterly unequal to the requirement, and the old circular machines very ill adapted thereto. Further, whereas in the old days defective large "brackets" could be cut down to small brackets and still find a market of sorts there is much less demand now for small brackets in the ¼" thickness that characterizes the larger sheets. The industry is therefore largely split in two, with the new machinery adapted to the new thickness, and the old machinery confined in its usefulness to the old industry of large store-front windows, for which purpose it may not immediately be ousted.

An attempt to popularize ⅛" glass for mirrors and the like in furniture seems to have fizzled out very promptly. At present it seems that the heavy ¼" glass is regarded as aesthetically sounder in this connection.

The invasion of the ⅛" field by the plate glass industry promptly brought its nemesis. This was of old the field of the drawn-sheet industry, and the development of ⅛" glass of polished plate quality was to the window glass maker both a threat and an opportunity.

The drawing of window glass thick enough to finish, after grinding and polishing, a full ¼", is not particularly easy nor rapid,—but glass to finish ⅛" is readily produced by the drawing process. This is particularly true, of course, of sheets of strictly moderate width. In consequence the question arose whether polished plate should be made in the first instance by rolling or by drawing; whether in short, the Fourcault and Libbey-Owens processes were to be thrown into direct competition with the Bicheroux and Ford Motor processes.

The Libbey-Owens Company had already, for some years, been experimenting with small circular tables of a slightly novel type for the production of polished plate from its drawn glass, and being satisfied that glass of that sort was needed and that circular decks were not the thing, installed a continuous grinding and polishing plant very similar in size, speed, and the main essentials to that of the Pittsburgh Plate. Early this year, an additional plant, duplicating or triplicating the first, was constructed. But in spite of their success in drawing, especially at Lancaster, Ohio, very good glass from a tank, Libbey-Owens a few weeks ago acquired the Edward Ford Plate Glass Company, which, as previously mentioned, had recently installed the Bicheroux rolling system and the Pilkington continuous grinding and polishing equipment.

The Ford City Company and Pittsburgh Plate both experimented with drawn glass, and the Clearview Glass Company installed a grinding and polishing unit of the continuous type for dealing with Fourcault drawn glass and rolled wire glass.

The Pittsburgh Plate, following its success with the Creighton plant, installed continuous grinding and polishing units at Crystal City, Mo., and Ford City, Pa., but did not duplicate the Creighton tanks, feeling that for the present pot furnaces held the advantage.

In the window glass field, the American Window Glass Company, after many years use of the cylinder-drawing process, decided to turn over to Fourcault working. This leaves the Fourcault and Libbey-Owens (Colburn) processes alone in this field.

The net result of these developments seems to be that the gap between plate and window glass has been partly bridged. It is no longer the case that window glass is produced only in thinner, smaller and inferior pieces as compared with plate glass. While drawn glass has been getting thicker, larger and of better quality, much of the effort of the plate glass manufacturer has been directed toward getting his product thinner, smaller, and cheaper. To strengthen their position, window glass manufacturers have acquired plate glass subsidiaries and vice versa.

The next development may equally well be a closer tying together of the two branches of the industry, or a new cleavage along different lines. The events of the next few years will probably clarify the issue.

Laminated Glass the Biggest Contribution to Safety

A statement made at Washington, D. C., by Thomas B. Henry, president of the A. A. A., predicted that non-scattering glass would before long come into universal use in automobiles, buses, trucks and other forms of mobile transportation. He stated that the use of this type of glass in windshields and windows of motor cars is the biggest single contribution to safety in recent years. He claims that its use in all cars will eliminate at least one-half of the total number of accidents which occur in this country, 50 per cent of which are due to flying glass. A survey of twenty-six states developed the fact that 65 per cent of the injuries occurring were attributable to glass. New York State, Massachusetts and Delaware legislatures are all considering the establishment of laws requiring the use of non-scatterable glass in doors, windows and partitions in all motor vehicles engaged in the public transfer of passengers. Experts testifying before a committee of the legislature of Massachusetts testified that by the adoption of safety glass for all motor vehicles the total number of injuries in the United States could be reduced by 350,000 annually. Large motor bus operators such as the Public Service Corporation of New Jersey have not waited for compulsory legislation but have made it standard equipment. It was testified that several operators had found that their installations of non-scatterable glass had paid for themselves during the first six months of operation resulting in a saving in accident claims. Glass manufacturers who testified before the committee testified that the demand for non-scatterable glass had resulted in revolutionary changes in glass-making methods. One manufacturer alone is said to have spent approximately $14,000,000 for changes in equipment designed to produce the thin glass sheets used in making the laminated type of glass for use in automobiles.

Arsenic as an Ingredient in Glass

By WILLIAM BLOCH* AND D. E. SHARP†

ARSENIC is made an ingredient in a glass batch for one or more of three reasons. First, its effect as a refining agent or clarifier; second, its effect on the color of the glass; third, to produce opalescence. Much has been written on the effects produced by arsenic, but some of the conclusions of the various authors are open to doubt. One reason for some of the uncertainty is in the use of the words "clarifier," "refining agent," "decolorizer," "brightener," "whitener" and so forth. It will be well, therefore, for us to try to avoid the use of these terms, except insofar as we define them definitely.

When we refer to a "refining agent," therefore, we wish to give the impression that the substance, if used in the glass batch, promotes fusion by some property inherent in itself, other than like that of an alkaline flux, and that the glass becomes seed-free and ready to work, either in a shorter time or more surely.

The various writers on the subject of arsenic as a refining agent differ markedly in their opinions. Tscheuschner,[1] in the latter part of the last century, expressed the opinion that the action of arsenic was partly mechanical and partly chemical; as it volatilized it exerted a stirring action on the glass because of the bubbles formed. Chemically, arsenic was supposed to act as an oxidizing agent, becoming reduced to elementary arsenic which later was vaporized. Similar opinions have been expressed by others.

J. D. Everett, when he translated Hovestadt's Jenaer Glas was apparently puzzled by some of the uncertainties regarding arsenic. In the data he gives on the subject,[2] Dr. Schott is quoted as of the opinion that if oxidizing agents are not present no arsenic remains in the glass, the arsenic being driven off in vapor and exerting no influece. If oxidizing agents are present, the arsenious oxide is converted to arsenic pentoxide.

W. Rosenhain,[2] on the other hand felt that when arsenic did enter into the composition of glass it did so as trioxide. He wrote that "arsenic acid or its compounds, when they are present in glass at all, either form insoluble impurities or cause it to become opalescent."

More recently the work of Scholes,[3] Gelstharp,[4] and Allen and Zies[5] has confirmed definitely the fact that arsenic can exist in glass either as the trioxide or pentoxide. Nevertheless, they were unable to bring forward any more conclusive evidence that arsenic either did or did not have any value as a refining agent.

Investigations in this laboratory have indicated that arsenic does have some slight value as a refining agent if employed in an oxidizing batch. In the presence of reducing agents it apparently has no value whatsoever, in promoting fusion. Nevertheless, in spite of our express conclusion, the evidence is so uncertain and the methods of testing so unreliable that we would anticipate difficulty in supporting our assertions by proof. Indications are, however, that arsenic trioxide is oxidized at fairly low temperatures to arsenic pentoxide and as higher temperatures are reached, this dissociates into oxygen and arsenic trioxide; either, or both, of which aid in the fining. This opinion was first put forth by Schott[6] and concurred in by Allen and Zies.[5]

Research at the University of Sheffield, however, seems to indicate that with some glasses the use of arsenic is advantageous and in others it is not. In Part 1, of the work of Firth, Hodkin, Perkins and Turner,[7] the authors conclude that "no beneficial effect on the rate of melting has been found to be associated with the presence of arsenious oxide in the batch, and with large amounts of the oxide a higher melting temperature is needed than without it." In Part III the authors repeat "that in the absence of nitre from the batch, increase in the arsenic content does not assist in reducing the time required for the melting of the glass of types studied" (soda lime glass).[8]

English, Firth and Turner found that the progressive addition of arsenic did have an effect in speeding up the rate of melting of potash-lead glasses.[9] They found the best results were obtained with between 20 and 30 parts of arsenious oxide per 1,000 sand.

In view of the interesting experiments carried out in the same laboratories in which it was found that water added to the batch in the amount of about 3 to 4% had a decided effect in reducing the melting time,[10] one cannot help advising those who are using arsenic for speeding up melting in soda lime glasses to cease this practice and to use a sprinkling can. If there is uncertainty about the value of arsenic as a refining agent at least there is none about the use of water. The difference in cost is as marked as their difference in other ways.

The use of arsenious oxide for "blocking" or "boiling up" should also be considered in respect to its being an aid in fining. Blocking is resorted to, occasionally, when it has become difficult to clear a glass of seed by ordinary means. It consists of plunging a small quantity of volatile material into the glass while in the molten condition. Sometimes a green stick is used in this manner, or a block of wood that has been well soaked in water. A potato, carrot or similar vegetable seems to be equally popular although arsenic is quite commonly used.

Blocking is effective when the source of the seed is a layer of volatile material on the bottom of the pot. Selenium ruby can be cleared of seeds in this manner. Nevertheless, it should be noted, that when a layer of selenium is found on

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[1]Tscheuschner, "Handbuch der Glasfabrikation," Leipzig, 1885, pp. 124-5.
[2]Hovestadt, "Jena Glass." Translated by J. D. and A. Everett Macmillan, 1902, p. 412.
[3]S. R. Scholes, J. Ind. Eng. Chem. 4, 16 (1912).
[4]F. Gelstharp, Trans. Am. Ceram. Soc., Vol. 15, 585 (1913).
[5]Allen and Zies, "The Condition of Arsenic in Glass and Its Role in Glass Making," J. Am. Ceram. Soc., Vol. 1, No. 11.
[6]Schott, Doelter's "Handbuch der Mineralchemie," Leipzig 1, p. 861 (1912).
[7]E. M. Firth, F. W. Hodkin, M. Parkin and W. E. S. Turner, "The Function of Arsenic in Soda-Lime-Silica Glass." Part I, J. Soc. Glass Tech., Vol. X, No. 37 (1926).
[8]Edith M. Firth, F. W. Hodkin, W. E. S. Turner and F. Winks, "The Function of Arsenic in Soda-Lime-Silica Glass, Part III, J. Soc. Glass Tech., Vol. XI, No. 42 (1927).
[9]S. English, Edith M. Firth and W. E. S. Turner, "The Function of Arsenic in Potash-Lead Oxide-Silica Glasses. J. Soc. Glass Tech., Vol. XI, No. 41 (1927).
[10]Edith M. Firth, F. W. Hodkin, M. Parkin and W. E. S. Turner, "The Influence of Water on the Rate of Melting, and on the Working Characteristics of Soda-Lime-Silica Glasses, J. Soc. Glass Tech., Vol X, No. 38 (1926).

the bottom of a pot, it means that a poorly proportioned batch is being used. Blocking is to be recommended as a temporary expedient only. The proper thing to do is to reduce the amount of selenium and to proportion the batch properly from other standpoints. Firth, Hodkin and Turner[11] have shown that when arsenic is used for blocking, practically none of it is retained in the glass. Its action in this case is apparently entirely mechanical in character.

In spite of the fact that many of the advocates of arsenic believe they are using it as a refining agent, the facts are that they are probably really using it as a decolorizer. By a decolorizer, we mean a substance which when added to a glass batch containing a small amount of iron or carboniferous material or both, will produce a clear colorless crystal glass, when without the decolorizer the glass would have had a pale greenish or yellowish color.

There are two general types of decolorizers, and their action is quite different. Both manganese and selenium are used as decolorizers, but either of these substances, in sufficient quantity will produce a pink glass. This pink is sufficiently complimentary in color to the green caused by iron, so that a combination of the two can produce a neutral glass with the appearance of entire lack of absorption of light. Nickel may also be used in this manner, and cobalt is useful to counteract slight yellowish tints. These decolorizers all operate by addition of more color to the glass.

The other class of decolorizers, of which arsenic is a member, operate chemically. Among these decolorizers are niter, saltpeter, sodium and barium peroxide, potassium dichromate, barium nitrate and so forth. These are all oxidizing agents; their efficiency depends on the amount of oxygen they liberate, and the period during the melting operation when this liberation occurs.

Carbonaceous materials color glass yellow or amber. It is obvious that an oxidizing agent can convert such a coloring material into a gas which may then be liberated from the melting mixture. It is probable that arsenic acts in this manner.

According to many observers of the effect of iron on glass, ferrous iron produces a green, while ferric iron produces a yellow color. This is not strictly true, as we shall see later, but it is close enough for the present. The yellow due to ferric iron is much less intense than the green from the ferrous iron. As a consequence, the oxidation of iron impurities by any of the oxidizing agents mentioned above would produce a less highly colored glass and the oxidizing agent could be truly called a decolorizer.

A popular theory regarding the action of arsenic is that it forms some compound such as ferric arsenate which is comparatively colorless. Although this is an ingenious idea, it makes two assumptions that may not be warranted. It assumes that ferric arsenate is formed, and it assumes that it is colorless. Regardless of this, the fact remains that arsenic is a powerful decolorizer. Indeed, when a good grade of batch materials is used no other decolorizer than arsenic is necessary. With lower grade materials, it becomes necessary to add, also, some manganese or some selenium and cobalt.

[11]Edith M. Firth, F. W. Hodkin and W. E. S. Turner, The Function of Arsenious Oxide in Soda-Lime-Silica Glass, Part II, J. Soc. Glass Tech., Vol. XI, No. 42 (1927).

Research at the University of Sheffield, definitely showed that the presence of arsenic alone in a batch decreased the color of soda lime glass. Moreover, its use in conjunction with selenium for the production of colorless glass was shown to be almost a necessity. As far back as 1885, Tscheuschner[1] advocated its use with manganese for overcoming the effects of an excess of this latter material.

In a series of tests made by one of us several years ago several small crucibles containing identical glass batches, except for varying arsenic content, were melted simultaneously in a Fletcher furnace. In each case, the glasses containing arsenic were colorless, whereas those free from arsenic were tinged with blue or green. In a similar series of melts, where each batch contained a small amount of manganese, the presence of arsenic produced an intensification of the manganese color, while the arsenic-free batches produced glass that was either streaked with pale green and a light violet color, or entirely tinged with green.

It has been well demonstrated that arsenic exists in glass either as the trioxide or the pentoxide. In the presence of strong oxidizing agents the majority of it is present normally as pentoxide. When the batch contains an excess of a reducing agent such as carbon the arsenic is present mostly as the trioxide. If As_2O_3 is fused at 940° C. in an open crucible, it is partly vaporized but the major part is oxidized to arsenate.[4] When heated at 1090° C. with calcium carbonate, part of the arsenious oxide is lost and the rest is all oxidized to arsenate.

If even in the absence of niter or such oxidizing agents, some part of the arsenious oxide is always oxidized to arsenate, then one would be inclined to believe that arsenious oxide would really act as a reducing agent. Such may be the case at low temperatures. Nevertheless, it appears that dissociation takes place at higher temperatures, whereby oxygen is released.

Hostetter and Roberts have shown that ferrous oxide may result from the dissociation of the ferric oxide in a glass.[12] Indeed, in their experiments they found a progressive change from a brown to a green color in potash lime silica glass as the temperature of melting was increased. Taking this phenomenon into consideration, along with the action of arsenic, it appears possible that the oxygen given off by the arsenic tends to prevent the dissociation of the ferric oxide.

An interesting condition which is the opposite of the above has been pointed out by Walter H. Rising.[13] He has shown that if tin oxide or metallic tin is added to a glass containing iron oxide and a reducing agent, the resultant glass is blue in color. Evidently the tin oxide has a catalytic effect on the iron oxide whereby the latter is more completely reduced at normal melting temperatures than would otherwise be the case. Ferrous iron, therefore, actually imparts a blue color to glass. The green color obtained under normal conditions is merely that obtained by a mixture of yellow from the ferric oxide and blue from the ferrous oxide. The actual shade of color obtained depends on the proportion of each oxide present. Normally, this will be a fixed color

[12]Hostetter and Roberts, Note on the Dissociation of Ferric Oxide Dissolved in Glass and Its Relation to the Color of Iron-Bearing Glasses. J. Am. Ceram. Soc., Vol. 4, No. 11 (1912).

[13]Walter H. Rising, U. S. A. Patent No. 1,737,686. Method of Producing Heat-Absorbing Glasses and Batches Therefor.

for any particular set of melting conditions. The addition of tin displaces the equilibrium increasing the ratio of ferrous to ferric iron. The addition of arsenic seems to act in the opposite way and lowers the ratio.

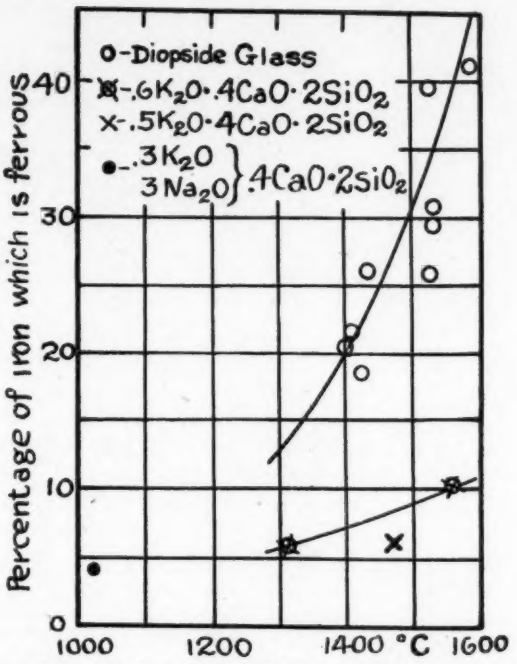


FIG. 1—IRON OXIDE DISSOLVED IN GLASS. COMPOSITION AND TEMPERATURE FOR CHARGES HEATED IN AIR (152 MM. ISOBAR)

Figure I shows the ratios that Hostetter and Roberts found for ferrous and ferric iron in meltings of glass made at different temperatures. The tests were made by melting each glass until it was homogeneous at the temperature selected, and then quenching the molten material quickly at a low temperature to prevent any dissociation which might have taken place if the glass had been allowed to cool at an ordinary rate.

The effects of arsenic on glass which have been discussed above, apply also to a number of colored glasses. Thus we might conclude that in potash lead glasses of various colors for art glass, arsenic might be of value in speeding up the melting time. On the other hand, arsenic might exert some effect on other coloring materials just as it does on iron oxide. Indeed, this is found to be the case, and so far as the evidence shows, the effect may always be traced back to the effect of arsenic as an oxidizing agent.

For example, the addition of selenium in appropriate amounts to a soda lime or potash lime glass produces under neutral or reducing conditions, a decided amber color. The addition of a nitrate to the batch makes a pink color develop in place of the amber. The addition of arsenic trioxide enhances this effect, so that arsenic should always be an ingredient in selenium pink glasses.

When selenium is used as a decolorizer, the same rule applies. In fact without arsenic, the glass is likely to develop as unsatisfactory a color as it would have had if no selenium at all had been employed. When there is no nitrate or arsenic in the batch, an excess of selenium produces an amber as is stated above. Too small an amount of selenium might actually augment the green caused by iron impurities. As a result, it is easy to jump to the conclusion that arsenic overcomes the effect of an excess of decolorizer, but probably what happens is, that arsenic produces a more standard set of conditions, so that a given amount of selenium adds a given amount of pink to the glass. Without arsenic, the least change in furnace conditions produces a variation in the color of the glass. It should be remembered that selenium produces a pink under oxidizing conditions.

Moreover, if selenium is used under reducing conditions it produces either an amber or yellow glass; if zinc oxide and cadmium sulphide are present it will produce any color from yellow through orange to deep red. If arsenic is added to such a batch the color becomes weaker, again bringing out the fact that arsenic acts as an oxidizing agent.

In glasses containing manganese dioxide the action of arsenic is the same as in the selenium pink glasses. In this case if the atmosphere is reducing, the manganese loses oxygen and colors the glass a faint green. Under oxidizing conditions the glass takes on an amethyst color from the higher oxides of manganese. Because arsenious oxide acts as an oxidizing agent, we naturally get a stronger color when arsenic is used.

It is worth noting also, that arsenic is a valuable adjunct when manganese is used as a decolorizer. In this case, too, arsenic does not act as a means of overcoming the effects of an excess of manganese, but by causing the melting conditions to become more standard and less dependent on the furnace atmosphere. The quantity of arsenic to add for best results depends upon the melting temperature, the amount of iron oxide in the glass, the presence or absence of oxidizing agents and so forth. Generally an excess is used, because it does no harm, and it is cheaper to use a little more arsenic than to run a chance of having a poorly decolorized glass. Two to three pounds of arsenic trioxide per 1,000 lbs. of sand is usually sufficient, but occasionally even five or more pounds are used. If the sand is moist, an excess of arsenic may cause some scum, but this can easily be eliminated by the use of a small amount of salt cake.

The action of arsenic on glass which is to be used for reworking, is not to be overlooked, in any consideration of the color effects of arsenic. The blackening of lime glass tubing in the flame has been generally attributed to the reduction of small amounts of lead oxide introduced accidentally by the use of lead glass cullet. However, both arsenic and antimony have been found to be most undesirable from this standpoint. Thorough tests have shown[14] that even two to five parts of arsenic or antimony trioxide in 10,000 of glass will yield a product which discolors in the flame. This action takes place regardless of the presence or absence of other oxidizing agents such as niter or manganese dioxide. Much larger amounts of lead oxide must be present in a glass before even a reducing flame will produce any blackening. In fact the content of PbO must amount to 0.6% or more of the glass.

Besides its use as a refining agent and as a decolorizer,

[14] F. W. Hodkin and W. E. S. Turner. The Discoloration Produced by Lead, Antimony and Aresnic in Lampworked Glass Tubing. J. Soc. Glass Tech., Vol. IV, No. 14 (1920).

arsenic may be used as an opacifier in glass. While it is seldom used without a considerable amount of bone ash, tin oxide, or both, it can be used alone.

For most commercial purposes, tin oxide, bone ash and even arsenic are too expensive to use for opal glasses. In some special glasses such as thermometer tubing, where the considerations of uniformity and the other losses in the process outweigh the expense, the above ingredients are still used, more or less. A few batches for typical opal glasses containing arsenic are given in Table I.

Table I

No.	1	2	3
Sand	100	100	100
Potash	30	30	...
Soda	...	...	...
Lead Oxide	70	50	100
Bone Ash	10	...	...
Tin Oxide	10	15	...
Arsenic	10	8	7
Borax	4	...	...
Saltpeter	7	6	11
Cryolite	...	10	...

Batches No. 1 and No. 3 are for dense opal glasses. No. 2 is a lighter or opalescent glass.

It would not do to dismiss the subject of arsenic without mentioning briefly the possibility of its being dissolved out of the glass, for example, by the liquid contained in a bottle. This bug-a-boo has appeared from time to time, as a result, usually, of the over zealousness of some layman who had learned for the first time that arsenic is used in glass, and who sought to preserve the health of the community by broadcasting the terrible news.

Fortunately, it is possible definitely to contradict any such statements since the work of Firth, Hodkin and Turner[11] Their experiments show, that if the glass has a satisfactory durability in other respects, the risk of dissolving out any arsenic is quite negligible. Indeed, the only tests in which any arsenic could be extracted from glass in determinable amounts were when strongly alkaline chemical reagents were heated for several hours in a glass. The action of strong vinegar for example was entirely without effect. As it is unlikely that anyone would be drinking strong alkali solutions unless with suicidal intent, the possibility of the presence of extremely small percentages of arsenic in such a solution is of little moment except to the chemist.

Summary

Arsenic is used in the glass industry as a refining agent, a decolorizer and an opacifier. Its most valuable function is as a decolorizer. Arsenic operates chemically in glasses as an oxidizing agent at high temperatures. Its expense prohibits its general use as an opacifier. Arsenic should never be used in glass that is to be reworked for it causes the glass to blacken in the flame. Foodstuffs may be preserved in arsenic bearing glass without becoming contaminated with arsenic.

The Rate of Crystal Growth in Technical Soda-Lime-Silica Glasses

By DR. ADOLF DIETZEL*

Translated by K. H. Lunde and F. W. Preston

(Continued from the June issue)

GLASS No. 18

Na_2O 16.00%, CaO 16.02%, SiO_2 67.71%, Al_2O_3 etc. 0.27%

TABLE XXI.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
850°	10	97			
		100	104	10.4	Wollastonite
		103			
		107			
900°	5	140			
		147	148	29.6	Wollastonite
		152			and
		153			
		22			
		24	23.6	4.7	Pseudowollastonite
		25			
950°	5	341			
		345	346	69	Wollastonite
		354			and
		77			
		81	82.2	16.4	Pseudowollastonite
		85			
		86			
1000°	5	587			
		595	597	119	Wollastonite
		608			and
		98			
		101	101.3	20.2	Pseudowollastonite
		105			
1050°	10	503			
		517	513.3	51.3	Wollastonite
		520			and
		50			
		54	53	5.3	Pseudowollastonite
		55			

FIG. 39. GLASS NO. 18 1000° C. PSEUDOWOLLASTONITE MIXED WITH WOLLASTONITE. SURFACE OF SPECIMEN.

Temperature of Most Rapid Growth 1005° C.
Maximum Rate of Growth 120 μ/minute.
Softening Temperature 850° C.

Figures 39 and 40 show photomicrographs of pseudowollastonite mixed with wollastonite in a specimen devitrified at 1000° C for 5 minutes as observed directly and in this section.

An interesting feature observed in a number of examples, and particularly distinctly in this glass, are the fractures produced in the specimens by the difference in the thermal expansions of the crystal and the mother-glass. Figure 41 shows a system of concentric fissures at right angles to the crystal needles.

For Curve see Fig. 42.

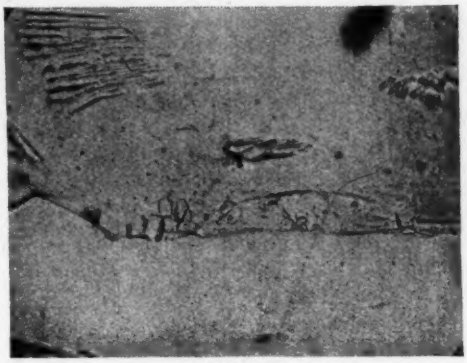


FIG. 40. GLASS N. 18 1000° C. THIN SECTION

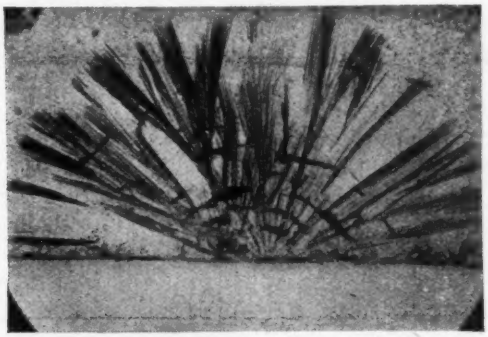


FIG. 41. CONCENTRIC FISSURES PRODUCED BY UNEQUAL EXPANSION OF CRYSTAL AND GLASS.

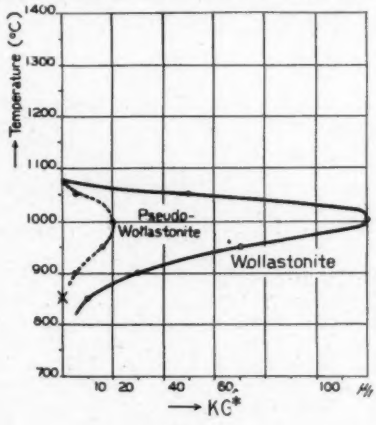


FIG. 42

GLASS No. 19

Na_2O 17.94% CaO 6.01%, SiO_2 75.89%, Al_2O_3 etc. 0.16%

TABLE XXII.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
800°	30	64			
		67	70	2.3	Cristobalite
		74			
		75			
850°	30	148			
		152			
		157	154	5.1	
		158			
900°	10	72			
		74	74	7.4	
		75			
950°	10	56			
		59	59	5.9	
		62			

* KG means rate of crystal growth.

Temperature of Most Rapid Growth 910° C.
Maximum Rate of Growth 7.5 μ/minute.
Upper limit of devitrification 1005° C.
Softening Temperature 875°.

In this as in the following glasses 20 and 22, the number of nuclei of devitrification is relatively very low, so that many specimens appear perfectly glassy to the naked eye, while in reality they contain crystals of 100μ in length.

For curve see Fig. 43.

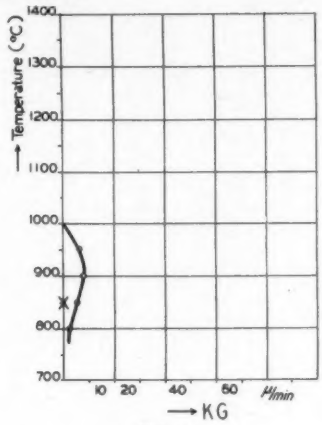


FIG. 43

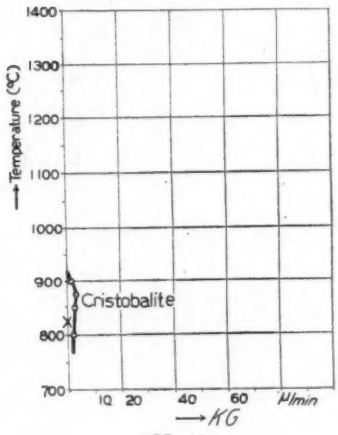


FIG. 44

GLASS No. 20

Na_2O 18.05%, CaO 8.05%, SiO_2 73.79%, Al_2O_3 etc. 0.11%

TABLE XXIII.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
800°	20	41			
		44	44	2.2	Cristobalite
		45			
		46			
850°	15	42			
		43	42.6	2.8	
		43			
875°	15	44			
		46	46.7	3.1	
		48			
		49			
900°	20	37			
		38	39.7	2.0	
		41			
		43			

Temperature of Most Rapid Growth, 875° C.
Maximum Rate of Growth 3.1 μ/minute.
Softening Temperature 850° C.
For Curve see Fig. 44.

GLASS No. 21

Na_2O 17.91%, CaO 10.07%, SiO_2 71.73%, Al_2O_3 etc. 0.29%

TABLE XXIV.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
850°	30	55			
		59	58	1.7	Wollastonite and
		60			
		33			
		33	33	1.1	Cristobalite
		34			
900°	30	200			
		204			
		205	207.6	6.9	Wollastonite and
		207			
		214			
		216			
		64			
		67	66.5	2.2	Cristobalite
		67			
		68			
925°	30	142			
		147	146.6	4.9	Wollastonite and
		155			
		58			
		59	56.6	1.9	Cristobalite
		63			

Temperature of Most Rapid Growth 900° C.
Maximum Rate of Growth 6.9 μ/minute.
Softening Temperature 850° C.
The number of nuclei for wollastonite is here very low in comparison with that for cristobalite, which, however, grows much more slowly.
For Curve see Fig. 45.

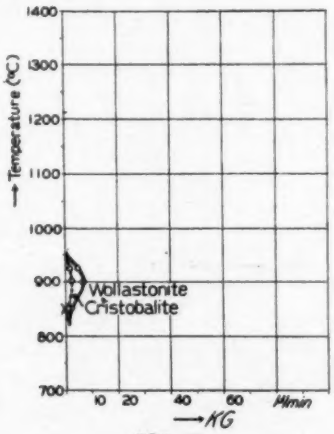


FIG. 45

GLASS No. 22

Na_2O 18.00%, CaO 12.03%, SiO_2 69.73%, Al_2O_3 etc. 0.24%

TABLE XXV.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
850°	10	54			
		59	58.4	5.8	Wollastonite
		62			
900°	5	87			
		94			
		95	99.6	19.9	
		110			
		112			
925°	5	106			
		110			
		112	111	22	
		118			
950°	5	137			
		142	141	28.2	
		144			
960°	5	136			
		140	139.3	27.9	
		142			

Temperature of Most Rapid Growth 950° C.
Maximum Rate of Growth 28.2 μ/minute.
Softening Temperature 850° C.
For Curve see Fig. 46.

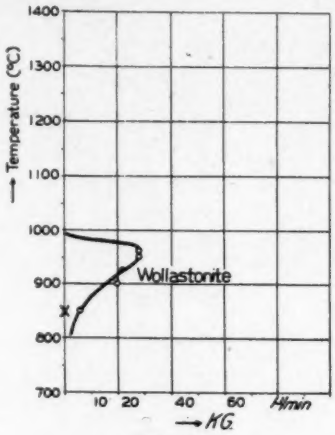


FIG. 46

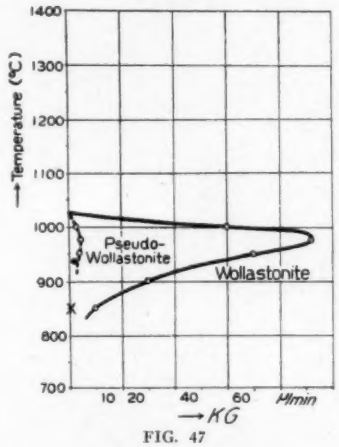


FIG. 47

GLASS No. 23

Na_2O 17.97%, CaO 14.06%, SiO_2 67.78%, Al_2O_3 etc. 0.19%

TABLE XXVI.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
850°	10	97			
		102	101.3	10.1	Wollastonite
		105			
900°	5	146			
		152	150.3	30	Wollastonite
		153			
950°	5	320			
		350			
		359	347	69.4	Wollastonite and
		360			
		18			
		19			
		20	19.7	4.0	Pseudowollastonite
		22			
975°	5	456			
		462	461	92.2	Wollastonite and
		465			
		20			
		24	23	4.6	Pseudowollastonite
		26			

1000°	5	294 196 305	298	59.6	Wollastonite and
		14 14 15	14.3	3.0	Pseudowollastonite

Temperature of Most Rapid Growth 975° C.
Maximum Rate of Growth 92.2 μ/minute.
Softening Temperature 850° C.
For Curve see Fig. 47.

GLASS No. 24

Na_2O 17.95%, CaO 15.97%, SiO_2 65.83%, Al_2O_3 etc. 0.25%

TABLE XXVII.

Devitrification Temp. °C.	Devitrification Time (Minutes)	Resulting Crystal Length (μ) (1μ=.001 mm)	Average	Rate of Growth μ/minute	Crystal Phase Precipitated
850°	10	118 124 132 145	129.7	13.0	Wollastonite
900°	5	246 249 253	249.3	49.9	Wollastonite
950°	5	440 448 465	451	90.2	Wollastonite and
		42 46 47	45	9.0	Pseudowollastonite
1000°	5	980 1005 1015 1020	1005	201	Wollastonite and
		39 40 42 42	41	8.2	Pseudowollastonite
1050°	5	130 152 160	147.3	29.4	Wollastonite

Temperature of Most Rapid Growth 1000° C.
Maximum Rate of Growth 201 μ/minute.
Softening Temperature 850° C.
For Curve see Fig. 48.

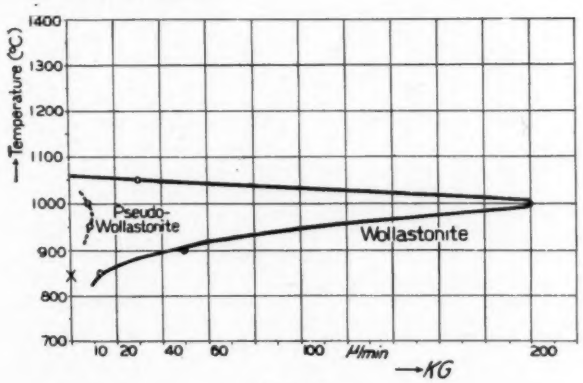


FIG. 48

§ 7. Influence of Thermal History on the Rate of Crystallization

As set forth in Section 2, all the glasses were poured out after the first melting, crushed, remelted and again poured out. With this method of attaining homogeneity it appears questionable whether the constitution of the glass might not have been altered through the quenching and remelting. This point has a particular interest since in industrial practice it has been contended that glass containing too much cullet is much more brittle in working than a corresponding melt made from fresh batch. For investigating this matter in so far as it concerns the subject of devitrification, there was chosen from our list of glasses, that one which should be most inclined to such a sort of alteration, namely, glass No. 21 containing 72% silica, 18% soda, 10% lime.

According to the diagram of Morey and Bowen this melt lies in the territory of the double silicate, Na_2O, 3CaO, $6SiO_2$. Since this compound, however, at about 1050° breaks down into wollastonite and glass, it was to be expected that a different sort of glass could be obtained by a suitably chosen heat treatment.

FIG. 49

These melts were formed according to the following various ways and then tested as to their devitrification behavior.

1. Batch melted at 1300-1400°, remelted once at 1300 to 1400° (normal melt).
2. Batch melted and remelted ten times at 1300 to 1400°.
3. Batch melted, stirred at 1300 to 1400°, and poured out.
4. Batch melted at 1300 to 1400°, remelted, then held for two days at 1000°.
5. Batch melted at 1000°, remelted, and held for two days at 1000°. Temperature not raised above the inversion point.
6. Batch melted at 1000°, remelted at 1300 to 1400°.

To our surprise the devitrification of these specimens produced in all cases nothing but wollastonite and cristobalite.[20] Furthermore the rate of crystal growth, if we allow for slight changes of composition as a result of several strong heatings, remains the same. As a control, the refractive index was determined for all the melts, 1 to 6 above. Here again the variation of the melts lay within the errors of measurement. It follows that the thermal history has practically no influence in changing the compounds in the glass, as one might have been led to expect.

For the purpose of the present work this conclusion was important, since one may state with confidence that no alteration in the devitrification constants had been produced in any of the glasses by a single remelting.

[20] By devitrifying a melt made at 900 to 1000°, and having the composition SiO_2 72%, CaO 8%, Na_2O 20%, a new sort of crystal came to light, probably the compound Na_2O, 3 CaO, 6 SiO_2. This took the form of four-sided plates, at times deformed. (Fig. 49) If these melts were heated for two hours at 1300 to 1400° only wollastonite crystallized out. Evidently then the double silicate had inverted.

(*To be continued*)

Getting Something Out of Nothing

By JOHN W. HAMMOND
General Electric Company

When the front page of a San Francisco newspaper is read in New York State a few hours (elapsed time) after it is printed; when a popular lecturer makes a ray of light produce music and transmit his voice across the room; when Australia chats with America, and engineers talk of bringing waterpower from Pacific slopes to within reach of industrial markets in the northeast—even the sophisticated denizen of this ultra-modern world begins to inquire "Wherefore?" And the answer he gets has more than a touch of the mysterious, for they tell him, "It's vacuum—it's all in the vacuum!"

Otto von Guerricke, 1672 A.D., Sixteen Horses Cannot Pull the Hollow Hemisphere Apart When It Is Held Together by Air Pressure Against a Vacuum.

In the vacuum! But can there be anything whatever in a vacuum—defined as mere empty space, devoid even of air? Tremendously and emphatically, yes! Truth, in the twentieth century, is more than ever stranger than fiction, for this is truth; and the man who first uttered the paradoxical statement, "The vacuum—there's something in it"—Dr. Willis R. Whitney, director of the research laboratory of the General Electric Company—conducts an institution which is engaged in nothing else than making truth stranger than fiction.

Little unobtrusive *glass tubes* each enclosing one of these curious areas of "nothing-something" enabled a whole newspaper page to be reproduced within three hours clear across the continent and allowed Admiral Byrd in New Zealand to converse with his friends in this country, "face to face" nine thousand miles apart. Similar vacuum devices measure the heat and light of far distant stars; sort, grade and count quantities of small articles; safeguard premises from burglary and fire; turn on lights when darkness approaches; operate train signals, control electric motors, actuate compasses for ships and airplanes. Man has succeeded in utilizing the vacuum for transmitting entertainment programs great distances through space without connecting wires, for sending his messages to inaccessible or isolated spots, for aiding materially in alleviating his physical ailments. Every time he even switches on electric lights in his home he relies implicitly upon vacua, and millions of cubic feet of such lightgiving "emptiness" are in nightly use throughout the world.

It has grown trite to allude to "scientific wizards." Yet the more trite it becomes, the more wizardy they perform. Getting something out of nothing—or practically nothing—is one of their concrete achievements today, for already they have obtained more wonders from the vacuum than a stage magician could extract from a silk hat.

The very nature of a vacuum gives it a tremendous aspect. Few persons outside the scientific world can readily conceive of a space entirely empty of matter, even of the gaseous substance termed the air. Hence, when the earliest scientific "magicians" began doing tricks with vacua they utterly astonished the laity. The classic experiment of Otto von Guericke with the two hemispheres was a long-remembered case in point.

Von Guericke, burgomaster of Magdeburg, was a pioneer in electrical science. His accomplishments included the invention of an air-pump with which he obtained a partial vacuum—not a high vacuum, such as is common today, but still one in which the air content was pretty thin. One day in 1654 he called by appointment on Emperor Ferdinand III., accompanied by two teams of eight horses each, with their drivers and various queer paraphernalia. He showed the emperor two copper bowls which, when placed together, formed a hollow sphere. Between them von Guericke inserted a ring of leather soaked in wax and oil, making an air-tight joint, but there was no mechanical connection whatever. With his air-pump he drew off a great deal of the air from the sphere through a hole which was closed by a tap.

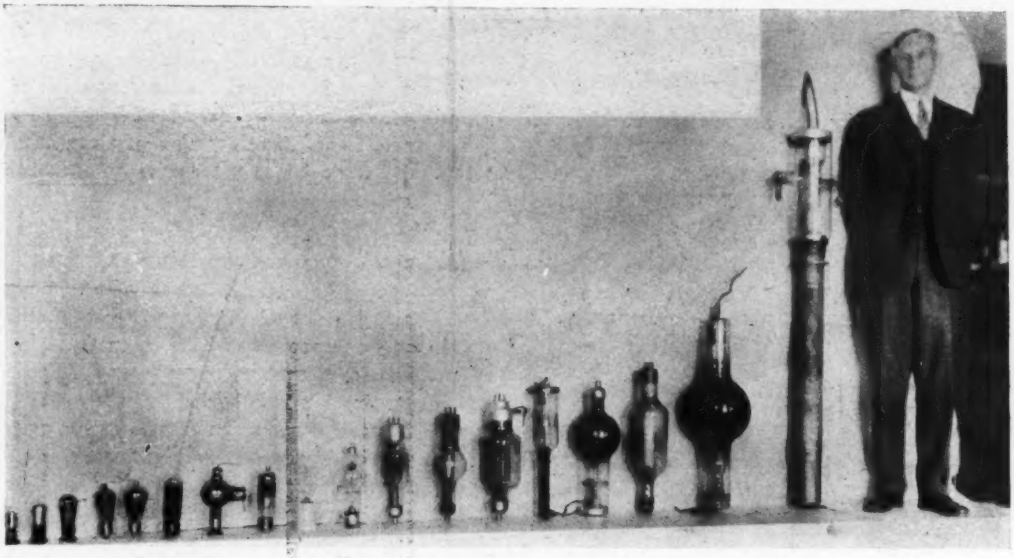
The teams of horses were then brought up, one being hitched to each of the copper bowls, or hemispheres. At the signal to go the sixteen horses pulled and strained, but their utmost exertions could not drag the hemispheres apart. The emperor, amazed, found it impossible to believe that the bowls were locked together merely by the difference in air pressure between the atmospheric density outside and the partial vacuum within.

This was the vacuum doing tricks. The vacuum universally at work did not come until two centuries later, and Edison was the scientific "magician" of this later affair. By that time men knew much more about electricity; and there is a close working relation between electricity and the vacuum. Edison hit on a relatively minor aspect of it when he placed a hair-like carbon filament within a vacuum and then connected the filament to an electrical circuit. The resistance of the filament to the passage of the electric current made it glow with incandescent light, while the vacuum prevented it from burning up—and lo! the incandescent electric lamp was born, essentially a vacuum device.

Edison, as fate would have it, did more than construct a practical and popular electric lamp depending on a vacuum. He was the first to observe a peculiar electric current originating with the hot filament inside the vacuum and known at the time as the Edison Effect. It was thirty years before scientists, working principally with Crookes' tubes, fully understood what this meant—that a hot filament in a vacuum gives off a stream of electrons (an electric current, but not usually a powerful one) capable of being

manipulated in many remarkable ways and behaving variously in vacua of varying degrees.

In the successive brilliant discoveries that occurred in this great field, Millikan, J. J. Thomson, Fleming, DeForest, Langmuir—all of them laboratory experimentors of the great line—participated. This work culminated at length in the modern vacuum tube with its boundless possibilities, already numerous and by no means even approaching finality. Radio broadcasting, one of the most spectacular and best understood of modern feats with vacua, was one of the earliest, following that of radio telegraphy.



"DADDY AND THE BOYS"—GROUP OF VACUUM TUBES DEVELOPED BY THE GENERAL ELECTRIC COMPANY. W. C. WHITE, DESIGNING ENGINEER (AT RIGHT)

Great numbers of these modern tubes are now in world-wide use, each with its vacuum, and each vacuum more nearly perfect than ever before produced by man. So completely are these tubes and bulbs "exhausted" (that is, evacuated of air) that out of every seven hundred million molecules originally in each tube only one remains! Yet in every cubic inch of space in each tube there are still to be found, after the pumps have done their best, more molecules of air than there are people in the world! Thus it is far from utterly empty space, although a living creature in such an enclosure would instantly suffocate, if he did not literally explode before he had time to smother.

This is quite sufficiently a condition of "empty" space, and innumerable such spaces are now in constant useful service in the every-day world. During the fall of 1929 General Electric manufactured its one hundred millionth vacuum tube. It is roughly estimated that about 250,000,000 tubes have been produced by all manufacturers since vacuum tubes first made their appearance, around 1915. If all these tubes are still in service they represent in the aggregate a million and a quarter barrels of vacua. Could all this "empty space" be lumped together in one spot it would have a larger cubic area than the interior of the Lincoln Memorial at Washington and almost as great as the Senate chamber and the national hall of representatives combined. And this does not take into account the vacua in incandescent-lamp bulbs.

They comprise a diverse and extraordinary scientific family, these vacuum tubes. The first of them was the well-known pliotron of Langmuir, which lies at the heart of radio broadcasting. The most recent, the thyratron, just developed by Dr. A. W. Hull in the General Electric laboratory where truth is made stranger than fiction, is capable of greatly simplifying electric power transmission and solving some of America's economic problems of power supply. Thus out of the vacuum—out of practically empty space—the scientific wizards of today have already brought whole industries, wealth, prosperity, advancement, perhaps a new phase of civilization!

Obviously, then, the present electric age, so-called, is unfolding in really astounding fashion. More and more the scientist is thinking of electricity—the invisible, inconceivably, tiny electron—as the warp and woof of the physical universe. If this be so, the electrical age not only has come to stay but it may in time reveal its successive distinctive epochs, like the geological eras in the age of the earth. The world has already passed through the magnetic-electrical epoch; now it is entering upon the vacuum-electrical. Perhaps this will be followed by the atomic-electrical, and that in turn by the cosmic-electrical, in which tremendous undiscovered forces of outer space will become servants of dominant man. In that epoch a literal tour of the solar system may have been practically achieved, and the world will have gaily despatched its interplanetary Lindbergh—a good-will ambassador to the stars! Fantastic? Ah, but "truth is stranger than fiction"—and stranger than ever as the years pass!

Crude Petroleum Production

According to preliminary figures compiled by the Bureau of Mines, Department of Commerce, from companies that operate gathering lines, 1,005,598 barrels of crude petroleum was transported from producing properties in the United States during 1929. The final figure of actual production (oil brought to the surface), which will include revisions to the monthly data, crude oil consumed on the leases, and the net change in producers' stocks, may amount to 1,006,000,000 barrels. This represents a new record for total production and is 104,500,000 barrels, or 12 per cent above the 1928 output.

According to preliminary data, the world's production of crude petroleum in 1929 amounted to 1,488,604,000 barrels, an increase over 1928 of 12 per cent. Of this total the United States produced 67.6 per cent as compared with 68.0 per cent in 1928 and 71.4 per cent in 1927.

Texas, for the second successive year, was the leading producing State, with an output of 298,441,000 barrels. California was comparatively close to the top, with a production of 292,037,000 barrels. Oklahoma dropped from second to third place, although its output of 253,704,000 barrels represented a small increase over 1928. These three states accounted for 84 per cent of the total.

The most important factors in the increased output of California were the rapid development of the various deep sands at Santa Fe Springs and the new production secured at Elwood.

Imports of crude petroleum during 1929 amounted to 78,915,000 barrels, or about 850,000 barrels under the 1928 figure. Over 50,000,000 barrels of these imports came from Venezuela and nearly 13,000,000 barrels, each, from Mexico and Colombia. Exports of crude oil increased from 18,966,000 barrels in 1928 to 26,374,000 barrels in 1929, or 39 per cent.

Stocks of crude petroleum (exclusive of producers' stocks) east of California increased from 368,353,000 barrels on hand January 1 to 381,391,000 barrels on December 31, an increase of about 13,000,000 barrels. This increase was less than the 1928 increase but in California the situation was quite different with about 36,000,000 barrels added to crude and fuel stocks compared with 2,000,000 barrels accumulated in 1928.

Glass Industry

ESTABLISED 1920

The First Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials and Glass Factory Equipment and Operation

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Tariffs in General

TARIFFS have two principal functions: in the first place they may be used to raise revenue. Thus most African countries have an import duty on firearms and cameras, as being convenient things to tax, and it is aggravating enough to have to pay a new levy on one's kodak every time one crosses a border. There are no local industries to protect, but it is a convenient way of raising money. Its origin is no doubt primitive, for in the remotest parts of the Congo, it was the custom only ten or twelve years ago, for a chief who could make himself "King of the waters" to levy a toll of half one's goods for the privilege of crossing the rivers of his territory.

In the second place tariffs may be used for the protection of home industries; and this system, excellent in conception, contains more seeds of viciousness, if not handled with extreme care, than the other. For when one is raising revenue, an increase of imports can be accommodated by a reduction of the rate of duty, and everyone is benefited, all parties having an interest in stimulating trade. But when one is taxing for protection, an increase of imports must be met by an increase in the rate of duty, which causes everyone to feel mean about it. Any enterprise on the part of the importer, any effort he may put into reducing his costs, must be met by purely arbitrary penalties to offset and nullify his labors. If a weak country tries tactics of this sort, the righteous indignation of the stronger one causes them to send fleets to open the recalcitrant ports; but when a strong country takes this line, the indignation can only smoulder.

Taken by and large, imports are paid for by exports, and while a wisely administered tariff may help to decide the form the imports shall take, any strictly prohibitory tariff will tend to reduce the total volume of imports, and this will involve a corresponding drop in exports. This is true, whether other countries raise counter tariffs or not; if they derive no income from their own exports, they cannot take imports from the U.S.A. and pay for them. For a time it may be possible to make them loans, and enable them to buy, forcing them gradually further into debt; and if the loans are used for buying locomotives and steel rails from the States, rather than automobiles for pleasure purposes, the indebtedness may be constructive, and help to develop the country. But in the long run, the loan, both principal and interest, has to be repaid in exports, and we shall then need a still higher tariff wall to prevent repayment of our own loans.

The net effect of prohibitory tariffs is to reduce the traffic on the high seas; we fail to see how a policy of protection is strictly compatible with the ambition to build a huge American mercantile marine. This ambition will certainly be frustrated if other countries follow our lead and erect impossible tariff barriers. There is this comfort of course, that if we do not need a mercantile marine, we do not need a navy to protect it, and that may save us money, and incidentally cut into the profits of U. S. and Bethlehem Steel. But of course, that is the steel man's "funeral," and as good glass men, we are more concerned to protect our own industry than to make profits on such investments as we may have in other industries. We know we ought not to dabble in the stock

market anyway, at least when it behaves as it has done lately. Besides, perhaps we can build a marine and a navy for ornament, and give the steel works employment thereby. We feel sure too, that we can appeal to the altruism of the American cotton grower and automobile maker, not to object to the injury to their industries, so long as ours is helped by their suffering.

In short, a tariff aimed at restricting imports, is a two-edged sword. Wisely used, it may be a very useful weapon; in the hands of the inexpert, it may do us as much harm as our competitors. Let us hope that the administration of the act proves wise, and that the benefits we expect for our own industry may not be offset by such injuries to others as to depress business ruinously.

Mellon Institute Expands

The new laboratory structure now being designed for the Mellon Institute of Industrial Research, as mentioned in the June number will be an impressive and beautiful addition to the group of fine buildings already located in the Schenley Park district of the city.

The building, which is to occupy the site of the Institute's building No. 2, is designed on classical lines, Ionic style, a plain, simple, but massive structure, surrounded by columns.

DESIGN FOR NEW BUILDING OF MELLON INSTITUTE OF INDUSTRIAL RESEARCH AT PITTSBURGH
Construction to begin next fall

It will provide ample space for housing many more Industrial Fellowships than the 63 that now tax the Institute's facilities to the utmost.

It is to be seven stories high, with monolithic columns along all four sides. The proportions will be approximately 300 feet by 400 feet. The main entrance, which is located on the third floor, is reached by steps extending along the entire front of the building. The laboratories are to face on interior courts. The design of the new building is to be such that additional laboratory suites can be constructed in the interior courts without marring the beauty of the general appearance and without interfering in any way with the original laboratory units.

In addition to providing a greatly increased number of laboratories, the new building will give more commodious quarters for the general departments. The present library contains 11,000 volumes; the new library is planned to acccommodate 250,000 volumes. The present Department of Research in Pure Chemistry will be expanded and facilities for pure research in other branches of science will be provided. Much more elaborate chemical engineering laboratories are to be available in the new building, and also the fellowships in each specific field of industrial research are to be grouped in suites of rooms so that they can best make use of general apparatus adapted to their needs. Certain rooms will be equipped for specialized phases of experimental technique, such as electrochemistry, spectroscopy, low-temperature studies, radiations, high-pressure experimentation, etc. Other special features to be included are a large lecture hall, a dining hall, an industrial fellowship museum, and an underground garage. For the past five years members of the Institute's Executive Staff have been visiting important laboratories in America and Europe to obtain information on new features in design and equipment.

The other departments of the institution will be increased in proportion. When the present home of the Institute was completed, in 1915, it was felt that the Industrial Fellowship procedure created by Robert Kennedy Duncan had passed from the experimental to the practical stage. The building, which was given to the institution by Andrew W. and Richard B. Mellon, incorporated the best laboratory constructional features of that period. It was thought then that it would provide adequate space for growth for many years; but for practically 10 years the Institute has had a waiting list of companies, often almost as long as the roster of companies whose problems were being investigated. Even the additional space afforded by Building No. 2, acquired in 1927, gave but temporary relief from the need for more laboratories arising from proposed new investigations and from the necessity of increasing the personnel of fellowships already in operation.

May Production of Polished Plate Glass

The production of polished plate glass for the month of May, 1930, was 12,571,414 sq. ft., as compared with 11,429,728 sq. ft. produced in the preceding month, April, 1930, and 12,781,975 sq. ft. produced in the corresponding month last year, May, 1929. This shows only the slightest decline under the figures of a year ago, at which time the business was considered booming.

The Laboratory

A Method for Silica in Lead Glasses

By S. R. SCHOLES[1]

The usual sodium carbonate fusion, while applicable to opening up lead glasses for the separation of silica, is attended by some risk. At the relatively high temperature needed, it is not certain that the lead oxide set free will remain stable, and a very slight reduction to metallic lead is deleterious to platinum. The addition of small amounts of sodium or potassium nitrate to maintain an oxidizing condition is likewise dangerous, because of the attack of these materials and the alkali oxides and peroxides which they generate, upon the crucible, at red heat. The low-temperature fusion described in this Journal, June, 1930, p. 137, furnishes a safe and convenient means of opening a sample of lead-bearing glass for analysis.

For silica estimation, the glass is ground in an agate mortar to pass a 100-mesh sieve, and 0.5000g. weighed into a platinum crucible. An equal weight of sodium hydroxide and about 3 grams of sodium nitrate are added, and the mixture brought to fusion over a small flame.

Owing probably to the heat of reaction between the silica of the glass and sodium hydroxide, there is an effervescence of fine bubbles. For this reason, the heat must be closely controlled, to avoid the carrying of undecomposed particles against the crucible lid. The reaction is complete in about one hour at 300° C. The melt is then allowed to cool, then dissolved from the crucible into a porcelain dish by means of hot water.

At this stage the lead oxide is present as a yellow suspension. A yellow stain of the same material clings to the crucible. This is easily removed by concentrated hydrochloric acid, measured in the crucible previous to adding to the contents of the dish.

There is very little evolution of gas when the solution is made acid, in agreeable contrast to the rather violent effervescence upon acidifying a carbonate fusion-product. If the digestion with hot water has been complete, the acid solution is practically clear.

The dish is now placed on a water-bath and the solution evaporated to dryness. Cover the residue again with dilute (1:1) hydrochloric acid, and evaporate again before taking up in acidified water for filtration. The purpose of the second evaporation is to convert nitrates to chlorides more completely.

It is hardly necessary to remark that the silica must be well washed with hot water, because of the limited solubility of lead chloride. The usual evaporation of the filtrate and drying of the residue at 120° C. is of course recommended.

[1] Fostoria Glass Company, Moundsville, W. Va.

Correspondence

To THE EDITOR:

Replying to your letter of June 25th, I have noted your paragraph on "Natural Glass" and also the most excellent view of Obsidian Cliff.[1]

It is perhaps unfortunate that the effect of this should be marred by inaccuracies in the legend below the picture. Obsidian is not necessarily vesicular; Obsidian Cliff in particular is as dense as any glass. Neither is it correct to say that it consists mainly of aluminum silicate. Its composition is the same as that of the surrounding rhyolite. Neither is this material used in commerce as abrasive pumice-stone. There is a volcanic pumice (Island of Lipari) which practically furnishes the world's supply of abrasive pumice, but except for the fact that it is vitreous it resembles Obsidian Cliff in no detail.

It is of course a matter of minor consequence but I venture to question also whether an opaque glass like Yellowstone Park obsidian casts a shadow in any way different from that cast by crystalline rock or the corner of a shed.

Geophysical Laboratory (*Signed*) Arthur L. Day
Washington, D. C. Director
June 6, 1930.

[1] June, 1930, issue, p. 139.

New Books

"PHILOLOGICAL STUDIES IN ANCIENT GLASS," by Mary Luella Trowbridge, University of Illinois Press. 1930. pp. 206. Price $1.50.

The publication of such works as this is evidence of the growing interest in the history of the sciences and arts. For the last two or three generations we have been so busy putting our knowledge on a modern foundation and eliminating the errors of ancient traditions from our crafts, that we have had little time to examine what the workers of two thousand years ago thought about glass or any other material. Most of us knew very little, and all of us cared less, as to how glass was made in ancient Egypt or Babylon.

There has been a very distinct trend of philosophical interest in the last generation, however, from concentration on physics to a broad interest in human culture. We have learned more of the development of civilization since the digging of the Suez Canal and the British occupation of Egypt, than in all the thousands of years that preceded them. The spade of the archeologist in the Valley of the Kings, in Mesopotamia, Crete, and elsewhere has brought to light most unexpected details of the beginnings of our civilization. Among the least perishable of ancient trinkets are those made of glass and other "ceramic" wares, including the baked clay tablets on which the history of Babylon is recorded. It is accordingly a matter of more interest in these days than it was a generation ago, to find out what the ancients knew of glass working. We do not expect thereby to improve our present crafts, except possibly in the strictly artistic sense, but we can perhaps feel a little more kindly towards traditions of the past.

Miss Trowbridge does not go into any details brought to light by archeological spading. She confines her attention rigidly to the written notices of glass that appear in the works of Greek and Latin writers from the time of Homer to about 400 A.D. Two hundred pages of closely documented text bear witness to her industry, and testify to the importance of the glass industry two thousand years ago.

The work is mainly philological, and examines the meanings to be attached to scores of Greek and Latin works that apparently had to do with articles of glass or processes of glass making.

The earliest glass was a sort of paste, and was accounted a gemstone. Hollow-ware seems at first to have been molded around a core of sand, but with the development of the art of glass-blowing, glass became a household word. The time of Nero was a period of great development, but apparently the wealthy vied with one another in paying exorbitant prices for the finest examples. Nero himself paid a million sesterces ($45,000) for a single "capis" (one-handled bowl).

The great variety of uses that had been found for glass within almost prehistoric times suggests that the ancients almost exhausted the possibilities and left nothing for us to invent in modern times. Tables were made of glass, and columns of artificial "emerald." An Arabic legend has it that King Solomon floored his palace with glass and the Queen of Sheba took it for water. Burning glasses, apparently waterfilled globes, were used for cauterizing wounds. Before the end of the period under review

church windows were made of glass, but thieves sometimes stole them and remelted them, for it was easier in those days to make glass from cullet than from batch. (Glass technologists please note.)

The earliest glass seems to have been generally bluish in color, and is compared with sapphire, lapis-lazuli, and azurite (a copper ore). The material was then essentially a gemstone and one of the first practical uses found for it by the Egyptians was to make earrings for the sacred crocodiles.

We hope that Miss Trowbridge (now Mrs. Honey) and her sex, when they put on their earrings in the morning, will remember their reptilian ancestry.

P. S.—Where does the crocodile keep his ears?

PATENTS, TRADE-MARKS, COPYRIGHTS: LAW AND PRACTICE. By Oscar A. Geier. Clothbound 6" by 9", 128 pp.; published by Richards and Geier, Patent and Trade Mark Attorneys, 274 Madison Avenue, New York, 1930.

This is the fifth edition of a very useful little book on a subject which concerns, often very vitally, the men of the glass industry along with those of all others. It is written for the business man and technologist, not for the legal profession, and its language, definitions and explanations are clearer than we commonly find in such treatises. The book covers the essential features of the American Patent, Trade-Mark, and Copyright Laws. However, as the Copyright laws of the country are in a state of chaos at the moment, very little space is devoted to them in the book under review, which is essentially a treatise on Patents and Trade-Marks.

Particularly noteworthy are the sections devoted to the procedure in cases of interference, i. e., the clashing of patents applied for but not granted, and similar cases. There is also valuable matter dealing with suits brought under the patent laws.

A few pages are devoted to the handling of foreign patents, a matter of increasing importance with the development of the American export trade. Necessarily, however, in a book of this size, the complicated subject of foreign patents cannot be treated with sufficient thoroughness to be of much advantage. One of the world's needs at the present time is a general reform of the patent systems of most countries. The American patent office is scandalously handicapped by the present methods of financing it; the British have appointed a commission to investigate the functioning of their Office, which is far from satisfactory; and many important Continental countries never had a patent system worthy of the name.

Readers of this magazine may obtain a copy of the book under review, gratis, by applying either to the publishers or to the Editor of THE GLASS INDUSTRY.

New Aluminite Insulation Product

The Philip Carey Manufacturing Company of Lockland, Ohio, large manufacturer of asbestos, magnesia and asphalt products, has recently become associated with the Aluminum Company of America in the production of a new high temperature heat insulating material to be manufactured under the trade name "Carey Aluminite." In an announcement issued recently to industries using insulating materials it is stated that for the past two years the Carey research organization, the Mellon Institute of the University of Pittsburgh, and the research department of the Aluminum Company of America have been cooperating in the development of a commercial high temperature heat insulating material derived from bauxite, the ore from which aluminum metal is produced.

This material is now being put on the market. A unit producing commercial quantities is already in operation and the results of their research efforts, it is stated, have caused The Philip Carey Manufacturing Company to plan the erection of a half million dollar manufacturing plant at East St. Louis immediately adjacent to the Aluminum Company of America's ore plant, from which processed material will be delivered to the new Carey plant and there made into Carey Aluminite insulating blocks, bricks, etc.

The new Aluminite insulation is designed for use in connection with glass furnaces, electric furnaces, fire-brick boiler settings, heat treating furnaces, regenerator chambers and similar structures where internal temperatures range from 1,800° F. to 2,600° F.

The new insulation, it is stated, possesses the ability to resist the disintegrating effect of very high temperatures in addition to which it has excellent heat insulating value.

The first installation in the glass industry has been made on one of the glass furnaces of the Owens-Illinois Glass Company, at Alton, Ill., under the direction of their engineer, E. W. McVay. In this installation only the burner ports and a portion of the regenerator chambers have been insulated. Aluminite blocks 2½" in thickness were installed. The internal temperature in the glass furnace and burner ports normally runs about 2,600° F. External wall temperatures at the uninsulated ports run approximately 800° F. Where the 2½" thick Aluminite blocks were applied the temperatures at the junction of the brick and insulation was 1,550° F., and the surface temperature of the insulation 150° F.

In the case of the wall for burner ports the heat loss calculations showed, it is stated by the Carey company, a rate of 1,475 B. T. U. per square foot, per hour, through the uninsulated 9" thick brick wall, and a loss of 436 B. T. U. per square foot, per hour, through the same wall insulated with 2½" thick Carey Aluminite. In the case of the regeneration chambers, where lower average temperatures prevail and where 13½" thick brick walls are used, the loss through the uninsulated wall was 675 B. T. U. per square foot per hour, and the loss through the insulated wall 276 B. T. U. per square foot, per hour.

An unusual feature of this installation is the method of application made possible by the use of large size blocks which measure 2½" x 9" x 36" in contrast to the small standard insulating brick generally used.

The brick work of the burner ports must be repaired at intervals and this requires the removal of the insulation. A system of light buckstays was devised. This eliminates the usual cementing and wiring. Only a small quantity of insulating asbestos cement is used to insure the absence of voids at the joints. The outer natural surface of the block is left exposed.

The Aluminum Company of America has standardized on the use of the new blocks for their new electric furnaces to be erected at Alcoa, Tenn.

The Carey Company states that the material is being furnished in standard size blocks of the size mentioned above, these dimensions having been adopted because the insulation is intended primarily for use in connection with fire brick construction and each block is equivalent to eight standard brick. The object of the large size block is to reduce erection costs and reduce joints which are also the weak points in insulating structures for high temperatures.

In the announcement issued by the company the weight per cubic foot of Carey Aluminite is given as approximately 27 pounds. Other information regarding the temperatures at which it can be successfully used, its conductivity curve per 1" thickness and various mean internal temperatures, cross bending modulus, and crushing strength data are included.

American Ceramic Exposition Plans Progressing

Several space reservations have already been made by manufacturers of glass and ceramic products and of factory equipment for those industries in the second American Ceramic Exposition to be held in the Public Auditorium at Cleveland, Ohio next February, 23-27, under the auspices of the American Ceramic Society. Exhibits will be divided into two classifications, first, products and processing machinery and other equipment along with samples of raw materials used in the glass and other industries. All kinds of pottery will be included. Novelty and table glass, plate, window and ultraviolet glass and lighting fixtures will be in the glass section. Refractories will be shown in the section with heavy clay products. A branch office of the American Ceramic Society has been opened at 7016 Euclid Avenue, Cleveland, where preparations for the exposition are being advanced.

Assurances have been received from Cleveland newspapers, ceramic dealers, etc. of whole-hearted support. Valuable information available at the gathering on ceramic subjects, to say nothing of the value of the personal contacts made possible by the gathering of thousands of fellow ceramists, will undoubtedly attract a large number of glass men to this large affair next February.

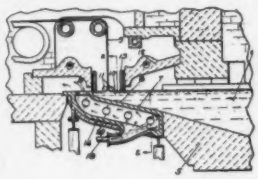
Coincidental with the exposition will be held the American Ceramic Congress, with technical meetings of various associations allied with this industry. The expected result is the largest gathering of people interested in the various phases of the ceramic field that has ever been brought together in this country. The meetings of the congress will be of inestimable value to those attending and the exposition will afford an opportunity to present to the trade and to the public a true picture of America's position in the ceramic field.

Recent Patents

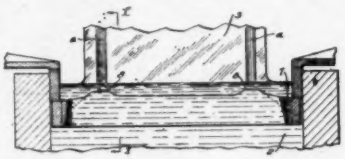
NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington, D. C., Price 10c each

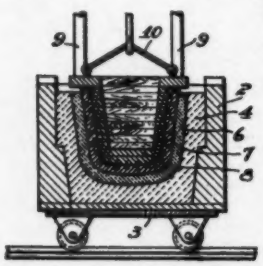
DRAW POT FOR SHEET GLASS APPARATUS. U. S. 1,761,220. June 3, 1930. Leopold Mambourg, Lancaster, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 12/9/26. In sheet glass apparatus, a metallic draw pot being formed preferably from a non-corrosive material, the said draw pot being formed from spaced walls to provide a heating compartment so that the temperature of the glass therein can be properly and accurately controlled and to provide a draw pot formed from a non-corrosive metal, the said draw pot having passageways through which heated air may be circulated, the outer wall of the pot being preferably insulated.



APPARATUS FOR DRAWING SHEET GLASS. U. S. 1,754,844. Apr. 15, 1930. John A. Watt, Clarksburg, W. Va., assignor to Pittsburgh Plate Glass Company. Filed 4/4/28. The combination with a machine for drawing a glass sheet continuously from a bath of molten glass, of a draw bar of refractory material submerged in the glass beneath the line of generation of the sheet having projections located directly beneath the marginal portions of the sheet and beneath the surface of the glass a slight distance inward from the extreme outer edges thereof, and approaching nearer to the surface of the bath than does the portion of the draw bar intermediate said projections.



GLASS-MELTING POT. U. S. 1,754,838. Apr. 15, 1930. Lee Showers, Charleroi, Pa., assignor to Pittsburgh Plate Glass Company. Filed 11/3/27. The invention relates to a glass melting pot. The invention has for its objects the provision of a poured pot, (1) which can be arched or burned without cracking without the exercise of any special care or precaution, (2) which will give long service, because of its ability to stand the strains imposed in handling and which at the same time is very resistant to corrosion by the molten glass, and (3) which has the foregoing desirable characteristics even with the largest size pots, which have hitherto been regarded as impracticable to make by a pouring operation. Briefly stated, this result is secured by pouring the pot in two layers, both made from the same batch, but the inner one being composed of materials which are more finely ground than those used in the outside layer.



The more finely ground material gives greater resistance to the corrosion of the glass than the more coarsely ground material, while the outer layer of more coarsely ground material gives a supporting body which will stand the strains imposed by handling better than the more finely divided material and which will not crack in firing.

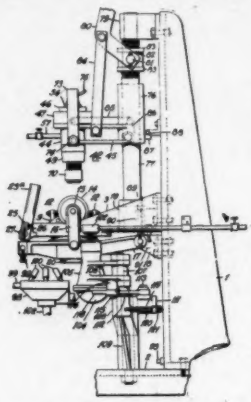
The batch employed may vary between certain limits, but preferably comprises the following approximate proportions:

40% raw clay (mixed ball and kaolin clays).

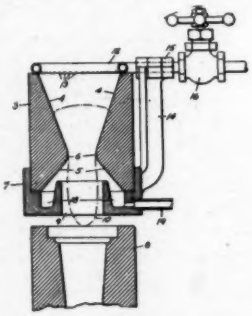
30% sand (part coarse and part fine).

30% pot shell (or other burned clay). In making the pots, the apparatus employed, is preferably that shown and described in the Fulton Patent No. 1,364,875 of Jan. 11, 1925, the last operation in completing the pot is here illustrated.

METHOD OF AND APPARATUS FOR MAKING HOLLOW BLOWN GLASSWARE. U. S. 1,756,813. Apr. 29, 1930. Robert W. Canfield, West Hartford, Conn., assignor to Hartford - Empire Company, Hartford, Conn. Filed 5/19/25. One of the objects is to provide a simple and effective method of making hollow glassware, including the steps of introducing a mold charge into a neck ring and blank mold; pressing the charge therein by a combined pressing plunger and blowhead to form a blank on parison; removing the blank mold; introducing blowing air from the blowhead to the blank and simultaneously applying a flame to the depending blank for reheating, shaping or supporting the blank, or for producing a combination of these effects; rotating the neck ring and blank during this stage; removing the burners to permit the partially blown blank to sag; closing a finishing mold about the depending blank, and introducing air from the blowhead to blow the blank to final form.

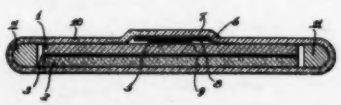


FEEDING MOLTEN GLASS. U. S. 1,756,493. Apr. 29, 1930. Karl E. Peiler, West Hartford, Conn., assignor by mesne assignments to Hartford - Empire Company, Hartford, Conn. Filed 3/17/14. This method consists in passing the charges of glass downwardly through a shaping die, the inner wall of which is of approximately hour-glass contour, as to its vertical lines, lubricated with a film of fluid or liquid, which enables and aids the glass to slip easily down the converging side walls to the contracted portion, through which it is extruded by the weight of the glass. The weight of the extending column of extruded glass hanging below the orifice helps to attenuate the column of glass at the orifice by drawing the sides of the glass inwardly past the wall of the die orifice. The outward divergence of the wall, aided by its liquid film, also assists in making a complete and continuing separation between the surface of the glass and the wall of the die.



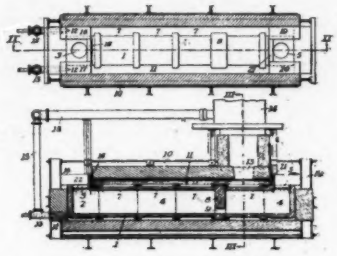
The lubricating film, after passing the contracted orifice, is conducted away from the surface of the extruded glass by the downwardly and outwardly flaring surface of the die, while the charge of glass, retaining the attenuated form it receives from the contracted orifice, passes downwardly from the die as shown in dot-and-dash outline in Fig. 2, and falls into the shaping mold below the die.

METHOD FOR REMOVING DEFECTS OF JOINDER FROM COMPOSITE GLASS PLATES. U. S. 1,755,274. Apr. 22, 1930. James H. Sherts, Glen Ridge, N. J., and William O. Lytle, New Kensington, Pa., assignors to Duplate Corporation. Filed 7/7/28. Composite glass plates ordinarily comprise a pair of glass sheets cemented to the opposite sides of a thin sheet of pyroxylin plastic, such as, celluloids or pyralin. It sometimes happens that at one or more points in the finished plate, a defect is found in the form of a hazy or gray spot, which unfits the plate for service. These defects are apparently due to imperfect joinder at the spots in question, such defects may, in



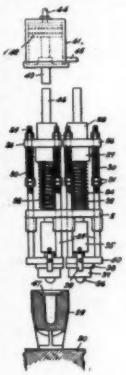
practically all cases, be removed by the use of the method and apparatus herein described. The apparatus comprises what may be described as a pressure localizing button with a stiff back and a face of yielding material; such as, rubber thickened at the center. In use, this button is pasted on one of the glass sheets over the defect and the entire plate is then subjected to the original conditions of heat and pressure. The thick center of the button concentrates the pressure of the button on the small area of glass engaged by the thickened center of such button, and the glass is apparently sprung in at this point, so that the contact necessary between the glass and celluloid, in order to perfect the joinder at such defective point, is secured.

CONTINUOUS GLASS-MELTING POT. U. S. 1,754,912. Apr. 15, 1930. Edwin E. Slick, Pittsburgh, Pa. Filed 9/2/26. This continuous pot for melting colored glass now melted in pots combines the advantages of the continuous process with the advantages of pot melting. The heating chamber 11 surrounds the pot on all sides. The heating flame is introduced through gas burners 12 and flows along the pot 1 through the chamber 11, and is discharged through stack 13 near the working end of the pot. Preheated air is drawn through a recuperator 14, heated by the exhaust gases through pipes 15, and is introduced with the burning gas from the nozzles 12. The pot is maintained full of the glass bath 22, so that the level of the glass is near the top of the pot, being preferably about the level shown in the drawings.



The exhaust heating gases from the furnace 10 may be employed for heating a glass-annealing leer.

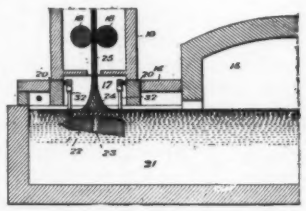
MULTIPLE PRESS HEAD FOR GLASSWARE SHAPING MACHINES. U. S. 1,756,728. Apr. 29, 1930. Clinton S. Budd, Clarion, Pa., assignor to Hartford-Empire Company, Hartford, Conn. Filed 11/3/25. It is desirable to provide the manufacturer with means for making articles having more than one finish, upon a single automatic machine and during the same operation of the machine. Two pressing plungers are shown for convenient illustration, and the press head carrying these plungers is arranged to swing periodically in response to the movement of the mold table to bring the plungers alternately or alternatively to the pressing station. At this station each plunger cooperates with a mold having a finish shape corresponding to the shape of that particular plunger, and the apparatus so equipped is therefore able to produce articles of two different neck-finishes in one operation of the same machine. The invention may also be carried out with three or more plungers of different shapes.



APPARATUS FOR ANNEALING GLASSWARE. U. S. 1,756,244. Apr. 29, 1930. George E. Howard, Butler, Pa., assignor to Hartford-Empire Company, Hartford, Conn. Filed 1/20/26. An apparatus for annealing glassware, comprising a tunnel having a metallic top wall and a metallic bottom wall both of said walls being exposed to the influence of the outer atmosphere, means for projecting unconfined streams of cooling air against said top wall at intervals longitudinally thereof, and means for independently projecting unconfined streams of cooling air and a heating medium against said bottom wall at predetermined points longitudinally thereof to control the temperature in said tunnel.

PROCESS AND APPARATUS FOR PRODUCING SHEET GLASS. U. S. 1,761,204. June 3, 1930. Frank Fraser, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 12/17/26. In sheet glass apparatus, a tank furnace for supplying a stream of molten glass to sheet forming means, including a slotted member for substantially equalizing the flow movement of the stream throughout its entire width as said stream flows from the tank the slot in said member being relatively narrow at its center and gradually enlarging towards its opposite ends.

APPARATUS AND METHOD FOR DRAWING GLASS. U. S. 1,755,523. Apr. 22, 1930. Arthur E. Spinasse, Mount Vernon, O. Filed 7/5/27. The arrangement of parts to prevent the crystallization of glass at the surface of the bath in proximity to the source of the sheet or plate glass being drawn. Also the improvement of means and method for supplying a cooled portion of anchored glass of substantially uniform viscosity throughout from which a flat sheet of glass may be drawn freer or devoid of wavy defects, lines or similar blemishes.



Patent No. 1,336,056, granted April 6, 1920, discloses a form of wedge slab submerged within the bath beneath the source of the article being drawn, but with a flat upper surface. This structure has been improved to the extent of better controlling and regulating the temperature and viscosity of the molten glass which passes over and about or through the slab. Another object to provide an improved anchorage and insure uniformity in the thickness of the article or sheet glass being drawn.

METHOD OF CUTTING LAMINATED GLASS. U. S. 1,752,567. April 1, 1930. Peter A. McCullough, Pittsburgh, Pa. Filed 10/2/28. The method of making sized pieces from laminated glass comprising scoring the surface thereof to outline the desired piece, chilling said sheet, and while chilled breaking the glass along said scorings.

METHOD AND APPARATUS FOR PRODUCING TUBULAR GLASS. U. S. 1,750,971. March 18, 1930. Leonard D. Soubier, Toledo, O., assignor to Owens-Illinois Glass Company, Toledo, O. Filed 10/16/26.

GLASS-FEEDING APPARATUS. U. S. 1,750,998. March 18, 1930. Enoch T. Ferngren, Toledo, O., assignor to Owens-Illinois Glass Company, Toledo, O. Filed 3/22/24. The regulator rod is not normally used to impel or cause a large volume discharge of glass as in the usual types of plunger feeders, but is principally used as a glass flow equalizing, retarding and amassing agent.

GLASS-HANDLING APPARATUS. U. S. 1,751,712. March 25, 1930. William Owen, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Company. Filed 6/25/28. Apparatus for handling glass sheets, and particularly sheets of plate glass after the polishing operation and during the steps of cleaning and inspecting.

GLASS CUTTER. U. S. 1,750,913. March 18, 1930. Adolf Vollm, Somerville, Mass. Filed 2/18/29.

SHEET GLASS SURFACING APPARATUS. U. S. 1,761,196. June 3, 1930. John L. Drake, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 2/19/26. A plurality of groups of surfacing members resting upon the glass, a second plurality of groups of surfacing members also resting upon the glass and arranged alternately with the first named groups of surfacing members, the surfacing members of the second-named groups being smaller than the surfacing members of the first named groups.

SHEET GLASS SURFACING TABLE. U. S. 1,761,746. June 3, 1930. William H. Powlesson, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 1/10/27. In sheet glass apparatus, a glass supporting table having a recess in its upper surface, and a plurality of pads loosely arranged within said recess in superimposed relation, and being freely movable independently of one another, the glass sheet to be surfaced being also received within said recess and resting upon the uppermost pad, the bottom pad being formed of asbestos and the uppermost pad of cork.

SHEET GLASS WIDTH MAINTAINING DEVICE. U. S. 1,761,219. June 3, 1930. Leopold Mambourg, Lancaster, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 3/5/26.

SHEET GLASS HANDLING DEVICE. U. S. 1,761,193. June 3, 1930. Joseph P. Crowley, Toledo, O., assignor to Libbey-Owens Glass Company, Toledo, O. Filed 10/9/24.

Appreciation Banquet Tendered Professor Silverman

Who Later Received the Honorary Degree of Doctor of Science

In recognition of twenty-five years of faithful service in the University of Pittsburgh, Professor Alexander Silverman, Head of the Department of Chemistry of that institution, was tendered a dinner in his honor on June 6 at Webster Hall, Pittsburgh. The celebration was arranged by the Chemistry Alumni Association of the University of Pittsburgh and about 200 members and friends attended the affair.

One of the principal events of the evening was the presentation to the University of a portrait of Professor Silverman; a painting

PROFESSOR ALEXANDER SILVERMAN

by Ellis M. Silvette, of which the accompanying illustration is a reproduction.

James N. Roche, was toastmaster and among the speakers were Dr. Harrison E. Howe, editor of *Industrial & Engineering Chemistry*, William J. Holland, Chancellor Emeritus of the University of Pittsburgh and Director Emeritus of the Carnegie Museum. Dr. Holland presented the portrait of Professor Silverman to the University, as mentioned above. This was accepted by J. Steele Gow, Dean of Chemistry and Acting Chancellor of the University of Pittsburgh. Secretary Ross C. Purdy of the American Ceramic Society spoke on "Silverman as a Glass Technologist." E. W. Gilliland, President of the Chemistry Alumni Association, presented an engraved watch to Professor Silverman, who responded appropriately.

The musical program included a violin solo by Charles Simon, accompanied by Ralph Lewando, and soprano solos by Miss Helen M. Greenwood, with Miss Helen Machette accompanying her.

In thus honoring the distinguished Professor, whose fame as a glass technologist has spread far and wide, the Association honored a native son of Pittsburgh.

Professor Silverman was born in that city on May 2, 1881, son of Phillip and Hannah (Schamberg) Silverman. His education began in the Pittsburgh public schools and Central High School. In 1902 he received a Ph.B. degree and in 1907 an M. S. degree from the University of Pittsburgh and in 1905 an A. B. degree from Cornell University. During his senior year at the University of Pittsburgh he was student assistant and tied for honors for the science prize. From 1902 to 1904 he was chemist for the Macbeth-Evans Glass Company, Pittsburgh. He joined the University chemistry faculty in 1905 and has continued that connection ever since. On December 16, 1908, Professor Silverman was married to Elrose Reizenstein of Pittsburgh.

Professor Silverman is, of course, a member of many scientific societies, clubs, and fraternities, particularly those interested in chemistry, including the principal organizations devoted to glass. He is councillor from the Pittsburgh Section of the American Chemical Society, member of committee on publications and committee on awards of the American Ceramic Society, member of the Societies of Glass Technology of England and Germany, member of the American Electrochemical Society and of the American Association for the Advancement of Science, Pennsylvania Academy of Science, American Association of University Professors, Chemist Club, New York, and belongs to several fraternities.

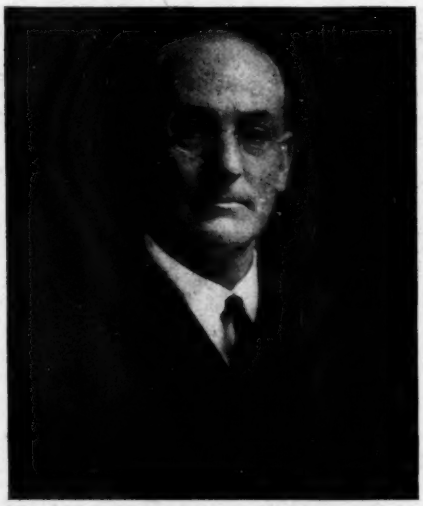
Professor Silverman has been a prolific writer on many subjects having published numerous papers in various society journals, transactions, etc. These publications and his lectures and addresses presented to such societies number well over 100.

A few days after the dinner, at the commencement exercises of the University of Pitsburgh on Wednesday, June 11, the honorary degree of Doctor of Science was conferred on Professor Silverman.

Passing of Fred M. Locke

Fred M. Locke of Victor, New York, who gained prominence through his effective research work and inventions in the ceramic field, died suddenly on April 15, while listening to the reading of a scientific article by his wife, who was his constant companion and deeply interested in his labors.

Only a few weeks earlier Mr. Locke's son and co-worker in the



FRED M. LOCKE

Locke Research Laboratory at Victor had passed away, this bereavement having undoubtedly shortened his father's life.

Mr. Locke was born in Honeoye Falls, New York, April 24, 1861, a son of Mr. and Mrs. William Morton Locke. After graduating from a local school he became a telegrapher and while interested in electricity and acting as operator and agent for the New York Central Railroad at Victor he spent much of his spare time in experiments. At that period many serious breakdowns of telegraph insulators occurred during storms, disarranging railroad schedules, and Mr. Locke began to experiment in his own kitchen with porcelain products, with a view to producing better insulators. In 1898 he met with success and his plant became the largest insulator factory in the world.

The business was incorporated in 1922 under the name Locke Insulator Corporation and large plants in Victor and Baltimore are operated. The laboratory had become large and complete.

His research work included ultraviolet ray transmitting glass and oven glass, a type of which he developed and upon which he and his son, Fred J. Locke, were engaged when death brought their labors to a close.

Mr. Locke was deeply devoted to family life and also found time to indulge several hobbies. He was an expert angler and photographer.

Fred J. Locke, the third son of Mr. and Mrs. Fred M. Locke, who, as mentioned above, passed away on March 5 at the Thompson Memorial Hospital, Canandaigua, New York, had been ill for some time and had undergone an operation for an ear affection. The strain on his system became too heavy, however, and his death resulted ultimately from heart failure. Fred J. Locke was born in Victor in 1889. After attending Victor high school he went to Cornell University, specializing in chemstry. During the world war he served his country at Aberdeen, N. C., doing scientific work, heart weakness having barred him from overseas service.

Besides his widow, four sons, Morton F., of Dobbs Ferry, New York; Louis P., of Victor; Peer A., of Ravenna, Ohio, and James L., of Victor, and four grandchildren survive.

Walter Cox

In making up the June issue a most regrettable mistake occurred in connection with the publication of the story of Walter Cox, whose death last fall deprived the industry of one of its prominent leaders. In assembling the type and cuts for the printer the wrong portrait cut was substituted for that of Mr. Cox. The portrait that appeared over the caption Walter Cox was not that of Mr. Cox but was that of Mr. Fred M. Locke of Victor, New

WALTER COX

York, whose recent death is recorded on another page of this issue. It is impossible to make adequate amends for such an error, very little can be said or done. However, we are publishing herewith the correct portrait of Mr. Walter Cox which is the one which ought to have appeared in the article describing his career, in the June issue.

Importing Soda Ash from Canada

Exports of soda ash from a factory at Windsor, Ontario, to the United States have, according to the Department of Commerce, taken on new importance. During a recent period this commodity held the leading position in the list of exports made from that port.

J. Spotts McDowell

Radio listeners like to know something about the speakers they hear "on the air" and it is the same with many readers of trade journals who like to become acquainted with the men whose activities are chronicled therein. A case in point is that of J. Spotts McDowell, Director of Research of the Harbison-Walker Refractories Company, who presented a moving picture film dealing with the manufacture of fire clay refractories at the recent meeting of the Pittsburgh Section of the American Ceramic Society as mentioned in the June issue. Mr. McDowell's regular job keeps him extremely busy, nevertheless he finds time occasionally to address technical meetings. So that our readers may know him better, we are printing his portrait herewith.

Like many other great men, Mr. McDowell spent the early years of his life in Virginia. His first job was with the Harbison-Walker Refractories Company of Pittsburgh and after some practical experience with this company, he went to the Massachusetts Institute of Technology for four years, and took a B. S. in mining.

J. SPOTTS McDOWELL

Thereafter he returned to his favorite company, where he has served in various capacities with the engineering staff, as technical investigator for the sales force, and finally as director of research.

During the past fifteen years he has written several technical papers on refractories, which have been in the *Journal* of the American Ceramic Society and other technical periodicals.

He is a member of the American Institute of Mining and Metallurgical Engineers' American Ceramic Society, American Chemical Society. American Society for Testing Materials, Ceramic Society (England), Society of Glass Technology, and of the newly formed American Society of Rheology.

Glass Container Magazine Has New Editor

Norman E. White, who for the last two years has been editor of *The Glass Container*, official publication of the Glass Container Association of America, has severed his connection with that organization to accept the position of assistant secretary of the Association of Cotton Textile Merchants of New York, with offices at 70 Worth Street.

Succeeding Mr. White as editor of *The Glass Container*, C. G. Hicks, present assistant editor, will assume full direction of that publication. Mr. Hicks has been with the container organization for the last fifteen months, prior to which he was on the staff of *Farm and Fireside*, *Toilet Requisites* and in the radio department of the *Brooklyn Eagle*.

Irish Free State Glass Trade in 1929

The official returns are now available relative to the imports into the Irish Free State during 1929. From these have been compiled the appended table showing the imports of glass and glassware into that country during the period in question as compared with 1928.

	1929		1928	
	Quantity	Value Dollars	Quantity	Value Dollars
Domestic and fancy glassware.cwt	17,678	$234,430	16,877	$217,320
Illuminating glassware	.....	349,545	.....	238,150
Plate glass .....sq. ft.	224,896	136,210	250,507	163,695
Other sheet glass.....sq. ft.	4,133,150	242,795	3,394,960	197,255
Bottles and jars (dutiable)..gross	12,080	47,445	38,164	144,935
Bottles and jars (non-dutiable).gross	82,344	320,630	43,182	174,335
Glass and glassware, n.c.s....cwt.	2,273	78,200	2,094	68,605
Totals		$1,409,255		$1,204,295

Although of the total imports $1,067,715 or nearly 76 per cent are credited to the United Kingdom it does not follow that the goods are all of British manufacture, the returns only taking cognizance of the ports of shipment. The balance is mainly credited to Belgium and Czechoslovakia.

Cox Patent Infringement Litigation

The bill of complaint filed in the United States District Court of Maryland in the case of the Hartford-Empire Company against Carr-Lowrey Glass Company of Baltimore for alleged infringement by the defendant of the Cox Letters Patent 1,212,189, dated January 16, 1917, records that Charles F. Cox, "the first original and sole inventor of certain new and useful improvements in method for gathering glass, etc., filed in the United States Patent Office as serial 721,138, an application for Letters Patent for said invention." The patent U. S. 1,212,189 was granted on January 16, 1917.

The owner of the patent, Charles E. Cox died and the patent was assigned by his executors to Whitall-Tatum Company, of New Jersey, which company later assigned to the Hartford-Empire Company the entire right, title and interest in the patent. The bill of complaint goes on to request that the defendant be brought before the court and also that a perpetual injunction, and preliminary injunction pending the suit, restraining the defendant and its agents from directly or indirectly infringing the said patent, be granted.

During the month of May, 1930, The O'Neill Machine Company, of Toledo petitioned the Court for the right to intervene as a defendant in the above case, stating that the apparatus used by the defendant was manufactured and furnished and sold by the petitioner or those acting for him, to the defendant Carr-Lowrey Glass Company. The petition points out that the Carr-Lowrey Glass Company is but one of a large number of different companies throughout the United States now using or contemplating the use of apparatus manufactured by the petitioner and of the same or general character as that charged in this suit to be an infringement of said Letters Patent to Cox, and that plaintiff threatens to bring suit against other users of such apparatus thereby threatening multiplicity of suits and injury to the petitioner's business, also that the petitioner has obligated itself in the manufacture of other like devices and apparatus to other manufacturers throughout the United States and a great injury will result to the petitioner and its customers or users of such devices should the rights of the petitioner be litigated without its having its day in court. The petition also points out that the defendant company has not itself sufficient interest in the result of this suit to properly defend it, and that the petitioner has great interest in the result.

The O'Neill Machine Company, having been permitted to become an Intervening Defendant, filed an answer to the complaint of the plaintiff, the Hartford-Empire Company, in the court at Baltimore under date of May 12, 1930. In this answer the Intervening Defendant admits that Letters Patent 1,212,189 were granted to Charles F. Cox on the 16th day of January 1917, but denies that all the requirements of the statutes of the United States then in force had been complied with. The answer also denies that the Carr-Lowrey Glass Company or the Intervening Defendant has committed any act or uses of infringement or that either of them is continuing to infringe. Paragraphs of the answer beginning with No. 12 read as follows:

"12. The intervening defendant is informed and believes, and therefore avers, with respect to said alleged Letters Patent sued on in the bill of complaint, that for the purpose of deceiving the public, the description and specification of said Letters Patent were made by Charles F. Cox to contain less than the whole truth relative to the alleged invention or discovery set forth therein, wherefor said patent is invalid.

13. The intervening defendant is informed and believes, and therefore avers, that the claims in said Letters Patent sued on in the bill of complaint are vague, nebulous and indefinite, and because of such vagueness, nebulosity and indefiniteness, each claim of said patent is meaningless, wherefor said patent is invalid; and on information and belief, intervening defendant avers that the claims of said patent were purposely made so vague, nebulous and indefinite as to be meaningless by the plaintiff or by Charles F. Cox to the end that the plaintiff might charge this intervening defendant and others with infringement of said patent, when in fact no such infringement has occurred, wherefore the said patent is invalid, and plaintiff has forfeited all exclusive rights which it might otherwise have had as the result of its alleged ownership of said patent.

14. The intervening defendant is informed and believes, and therefore avers, with respect to said Letters Patent in suit, that the alleged inventions and improvements described and claimed therein are not inventions or discoveries, or the proper subject matter of Letters Patent of the United States, but, in view of the state of the art existing at and prior to the said alleged inventions by Charles F. Cox, are the result of mere mechanical skill and judgment.

15. The intervening defendant is informed and believes, and therefore avers, with respect to said Letters Patent in suit, that the claims thereof are ambiguous, but that when such ambiguity is and shall be truly, correctly and lawfully resolved by reference to the specifications of said Letters Patent, to antecedent negotiations for said Letters Patent in the Patent Office of the United States, and to the art existing at and prior to the alleged invention of the subject matter of said claim by said Charles F. Cox, said claims and each of them will be legally susceptible only of such narrow interpretation, meaning and scope, that no act either done or intended to be done by this intervening defendant can justify and lawfully be held to involve infringement of any of said claims."

Intervening defendant avers that the alleged invention or improvement, or material and substantial parts thereof, described and claimed as new in said Cox Letters Patent 1,212,189, and attempted to be patented thereby, was, prior to the supposed invention or discovery thereof by said Cox, and/or more than two years prior to his application for a patent therefor, patented by twenty-four different parties whose names are listed in the complaint. He also avers that prior to the alleged invention by said Charles F. Cox a number of persons (listed in the complaint) had filed applications in the United States patent office disclosing in all substantial respects the subject matter attempted to be claimed by the said Cox patent 1,212,189. The Intervening Defendant's answer also states that the improvements purported to be covered by the Cox patent and all substantial parts thereof were known to others and were also used by others in this country before the alleged invention or discovery thereof by the said Charles F. Cox and were in public use or on sale in this country for more than two years prior to the application for Letters Patent 1,212,189. The names of fifteen companies manufacturing glass are listed in support of this statement.

The Intervening Defendant having, as he claims, fully answered the Bill of Complaint, requests that the complaint be dismissed with costs and charges.

John E. Cross, is solicitor for the plaintiff, John P. Bartlett of New York is of Hartford-Empire counsel; Byrnes, Stebbins, Parmelee & Blenko, and Bartlett, Poe & Claggett are of counsel for the Intervening Defendant, The O'Neill Machine Company.

Reduction of Income Tax not Allowed

Corning Glass Works, Corning, N. Y., was recently refused a review by the U. S. Supreme Court to test out its claim that it was entitled to deduct $240,000 from its gross income in making out its Federal tax returns for 1921 and 1922. The company argued that the expenditure should have been considered as an ordinary business expense, the amount having been paid to an underwriting concern, Estabrook & Company, for services in handling a $3,000,000 stock issue in 1921.

Industrial Publications

Pyrometers of Recording, Indicating and Automatic Controlling Type. Catalog L3, Wilson-Maeulen Company, 385 Concord Avenue, New York. A 56-page catalog giving photographic offset reproductions in 4/5 size of their complete catalog, including the section covering their new potentiometer recorder. The other catalog, An Inspection Tour of Industrial Plants, shows the many and varied types of furnaces which are successfully regulated by Wilson-Maeulen controllers and include an illustration of a gas fired lehr for annealing bottles at the Berney-Bond Glass Company, Columbus, O. These catalogs are available upon request.

Twin Breezo-Fin Unit Heater developed by the Buffalo Forge Company, engineers and manufacturers, Buffalo, N. Y. A pamphlet giving rating table of this new machine for steam pressures from five to forty pounds and other facts.

The Glass World and What It Is Doing

News of the Industry

Approve Standards for Plate Glass Mirrors

The mirror standardization conference announced on page 142 of the June issue to take place at Cincinnati, Ohio, on June 12, 1930, was duly held with a substantial attendance of members of the Mirror Manufacturers Association and other interested persons. The Recommended Commercial Standard for Plate Glass mirrors prepared by the Bureau of Standards, Washington, D. C., and printed in the June issue, was somewhat modified, then approved by the meeting and recommended for formal acceptance as the basis of every day trade. The purpose of this commercial standard is to establish and maintain a high level of quality for manufacture and sales of mirrors. Copies of the adopted standard have been sent to all mirror manufacturers and others interested with a blank acceptance form for the use of those who desire to show their approval of the principles outlined in the standard adopted.

The conference, held under the auspices of the Division of Trade Standards, Bureau of Standards, was presided over by Harry H. Steidle, and Fred H. Hagemann, chairman of the association's standardization committee, briefly outlined the desirability of uniform quality standards as a base line of operations for the mirror industry.

The proposed commercial standard grades were thoroughly discussed and numerous changes were made. In a desire to reduce the number of grades it was suggested that AA and A qualities be combined, but the consensus of opinion favored the retaining of both grades to take care of the rather small but very discriminating demand for the mirror of superlative grade.

Because of the inherent defects occurring in plate glass only a comparatively small quantity is available for AA and A quality mirrors and the bulk of production will fall under grades No. 1, No. 2 and No. 3.

There was some discussion as to changing the grade designations as proposed, but after mature reflection it was voted that they be retained as presented.

The defect known as "bull's eye" was ruled out of No. 1 quality.

Upon motion by O. J. Hubbuch, seconded by W. Thieleman, Jr., it was voted

"To approve the specifications as corrected and to recommend them to the industry for formal acceptance as the standard of quality for the mirror industry."

Under section IV of the proposed standard, "Detail Requirements," the following paragraph has been added:

"It is assumed that the majority of mirrors produced will fall under grades No. 1, No. 2 and No. 3. However, for that section of the trade that demands a mirror especially free from defects, the AA Quality and A Quality may be obtained in limited quantities by special selection."

V. Guarantee

For the guidance of the buying public, and the protection of the mirror manufacturer, each Commercial Standard grade mirror may be labeled in the color designated below, with the following statement for each particular grade:

White: "This mirror is guaranteed by its manufacturer to be of 'AA' quality as specified in Commercial Standard CS27-30 for Mirrors issued by the U. S. Department of Commerce.

....."
Manufacturer.

Red: "This mirror is guaranteed by its manufacturer to be of 'A' quality as specified in Commercial Standard CS27-30 for Mirrors issued by the U. S. Department of Commerce.

....."
Manufacturer.

Blue: "This mirror is guaranteed by its manufacturer to be of No. 1 quality as specified in Commercial Standard CS27-30 for Mirrors issued by the U. S. Department of Commerce.

....."
Manufacturer.

Green: "This mirror is guaranteed by its manufacturer to be of No. 2 quality as specified in Commercial Standard CS27-30 for Mirrors issued by the U. S. Department of Commerce.

....."
Manufacturer.

Yellow: "This mirror is guaranteed by its manufacturer to be of No. 3 quality as specified in Commercial Standard CS27-30 for Mirrors issued by the U. S. Department of Commerce.

....."
Manufacturer.

Under the heading Short Finish, a subhead was added, "Torn Short Finish, a streaked or blurred short finish."

The following organizations had representatives present:

National Mirror Works.	The Nurre Companies.
Libbey-Owens-Ford Glass Co.	Galax Mirror Co.
The George Behm & Sons Co.	Handy & Harman.
Central Glass Co.	The Dayton Art Glass Co.
American Home Economics Assn.	Neuer Glass Co.
General Fireproofing Co.	Wisconsin Mirror Plate Co.
Hires Turner Glass Co.	American Hotel Association.
National Ass'n of Furniture Mfrs.	Falconer Plate Glass Corp.
Hagemann Brothers Company.	Consolidated Mirror Co.
American Mirror Works.	The American Glass Co.
Hubbuch Glass Co.	Showers Bros. Co.
Southeastern Glass Co.	The Wm. Glenny Glass Co.
Pittsburgh Plate Glass Co.	Bureau of Standards.
Central Glass Co.	Mirror Manufacturers Assn.
John J. Kinsella Company.	Mid-West Glass Co.
Newport Glass, Mirror & Paint Co.	Hart Mirror Plate Co.
The F. H. Lawson Co.	Mirror Manufacturers Assn.
Libbey-Owens-Ford Glass Co.	Bureau of Standards.

American Window Glass Company's New Glass

The production of a new ultra-violet-ray glass to sell at ordinary window glass prices has just been announced by the American Window Glass Company.

MAKING LUSTRA GLASS BY THE FOURCAULT PROCESS

Lustraglass, as the new glass is named, is made by an improved process, vertically flat drawn. According to the announcement of the manufacturers, it is unusually clear, white, and perfectly flat,

being almost entirely free from the greenish color characteristics of the usual window glass. The new process is said to turn out glass of a remarkably uniform quality.

Data submitted by the company and stated to be the results obtained in tests of the glass by one of the foremost authorities on the physics of ultra violet rays include the following transmission figures:—

Wavelength	Transmission	Thickness
334 mu.	71%	0.090 in. (2.28 mm)
313 mu.	18%	same

The further claim is made that the glass transmits a substantial amount of these vital shorter rays of sunlight even at 310 mu.

Although no definite data has been submitted the glass is stated to have shown amazing results in growth, strength and root structure when used in experiments with plant life.

A disinterested grower wrote the American Window Glass Company, "Whatever rays . . . . flow through Lustraglass, the results are unquestionably conclusive."

Smoke of Tariff Battle Clears Away

News of the signing of the Hawley-Smoot Tariff Bill by President Hoover on June 17 was doubtless received with a sigh of relief by most of the men interested in glass making affairs. In the final outcome of the long drawn out battle, which began early in 1929, over Schedule 2, relating to earths, earthenware and glassware, between the protagonists for higher tariffs and their opponents, the glass trade scored a first-rate victory.

Our industry is one of the most fortunate of all of those whose interests lie in the high tariff policy. It has secured for itself in a large degree just what it wanted—the continuance of the increased duties on window and plate glass that were proclaimed by Presidents Coolidge and Hoover, and a number of minor modifications of duties on products that were obviously so low under the Fordney-McCumber tariff law of 1922, as to cause serious losses to both proprietors and workers of the industry in this country.

The Senate vote on the Hawley-Smoot bill on June 13 was favorable for its adoption by 44 to 22. The next day, on June 14, the House of Representatives passed the bill by a vote of 222 to 153, a majority of 69 votes. The President's signature was obtained June 17.

The complete official text of the tariff as finally passed by both houses of Congress may be obtained from The United States Daily, the United States Daily Building, Washington, D. C.

Club House for Corning Employees

Corning Glass Company, Corning, N. Y., has awarded a contract to The H. K. Ferguson Company of Cleveland, O., who are already constructing a new tube mill for them; for the design and construction of alterations and additions for an employees' club and recreation building. Plans provide for the remodelling of a three story and basement structure, fifty by seventy-five feet.

When completed the building will operate on the basis of a private club with every employee of the Corning Works as a member. Employees will have free access to the entire building but will be required to pay a small fee for the use of the swimming pool, bowling alleys and billiard tables.

A standard championship swimming pool, men's and women's social rooms and locker rooms will occupy the first floor and basement. The second floor will be occupied by bowling alleys and club rooms and the roof will be raised to provide room for a gymnasium which will occupy the third floor.

Plans for the project have been approved and construction, now under way, will be completed in about three months.

Clay Men to Meet at New York Athletic Club

There will be a meeting of clay producers at the New York Athletic Club, Wednesday, July 16 at 10:30 A. M. for the purpose of organizing, if possible, an association to work in the interests of the clay industry. Considerable discusssion has taken place on this subject and it is understood that the new association may follow similar policies to those which guided the Feldspar Grinders' Institute, which was formed a year ago and has already become an active force in the feldspar industry. The announcement of the clay meeting was made on June 25 by Commissioner W. J. Parker of the Feldspar Grinders' Institute.

William P. Clarke Attacks Hoover Administration

William P. Clarke, president of the American Flint Glass Workers' Union, in his annual report to the International Union of Flint Glass Workers at Toronto, Ontario, on June 30 asserted that it is lack of confidence in the leadership of President Hoover and failure of his administration to take steps to meet the industrial depression that has wrought "panic of such proportions that it almost staggers the imagination."

Declaring that evasion and subterfuge are the chief characteristics of the policies of officialdom in Washington, President Clarke sees a continuance of the widespread unemployment that prevails throughout the nation, and asserts there is no letup in sight. Unless a halt is called, he charges, "The masses of America will be further reduced to a condition of servitude and helplessness." He says: "The time for plain and unadulterated statements is at hand. Financial institutions are in jeopardy, lawlessness is on the increase and if conditions do not change the perpetuity of our form of government will hang in the balance.

"Evasion and subterfuge seem to be the chief characteristics of the policies of officialdom in Washington. They tell the public that times are getting better, employment is picking up, wages are not being reduced and that prosperity is just around the corner, when every sane person knows the reverse to be true."

A lengthy document giving advance details of Mr. Clarke's address, sent to the press from the Union's Toledo office for release June 30, contains further statements regarding his views as to prevailing conditions affecting workers in this country.

Abrasive Manufacturers Favor Simplified Practice

A general conference of representatives of manufacturers and users of aluminum oxide and silicon carbide abrasives for polishing uses and for grinding wheel manufacture, recently held under the auspices of the Division of Simplified Practice of the Bureau of Standards, Department of Commerce, at Washington, D. C., unanimously approved a simplified practice recommendation for these products, to become effective September 1, 1930. The simplification program is based on a table of allowable limits for the sizing of these abrasives as proposed by the producers of electric furnace abrasives.

In addition to the appointment of a standing committee, those in attendance were of the opinion that a technical committee should be formed for the purpose of conducting research on screens used in grading abrasive grains. At the suggestion of those present, two abrasive manufacturers, two screen manufacturers and two consumers will be invited to serve on this committee.

Ray S. Godard

Ray S. Godard, 11 Mount Lebanon Boulevard, Pittsburgh, Pa., who for the past five years has been engaged in sales promotion and engineering work for H. L. Dixon Company of Pittsburgh, which brought him in close contact with the glass manufacturing industry and especially with factory construction equipment and plant operation, has announced that he is entering the engineering and construction field on his own account and expects to establish an office in Pittsburgh in the near future. Previous to his connection with the H. L. Dixon Company, Mr. Godard has for a period of 13 years had charge of the engineering work for the Illinois Glass Company, Alton, Ill., then the largest manufacturer of glass bottles in the world. His work there included designing and construction of furnaces, buildings and equipment and general plant engineering.

George W. Aiken of Fabrica de Bottellas, "Bacardi", Havana, Cuba, recently sent the news that he is well on the road to recovery after an operation on May 1 for appendicitis. He reports that he was only kept in bed for nine days and thinks he had a comparatively easy time of it. He reports that the Bacardi bottle factory is going along nicely and growing steadily, although the market in Cuba is decidedly limited. The plant was formerly making all beers up to the first of April, but is now running two machines on light green sodas. The company almost monopolizes the Cuban soda bottle business.

The Owens-Illinois Glass Company is being sued by the administrators of the estate of Michael J. Owens for an accounting of its business beginning January 20, 1930. The petition alleges that the defendant had agreed to pay large royalties to the estate each quarter, but that none had been paid since January 20, and that notice has been given that none will be paid in the future. It is claimed that Mr. Owens, when president of the Owens Bottle Company, made the royalty agreement in exchange for patents he transferred to the concern.

The Hazard Advertising Corporation, the agency which handles the advertising of several concerns using advertising space in this journal, has moved into new offices in the Colonial Building, 295 Madison Avenue, New York. They are also opening a branch office in Boston in charge of Theron S. Curtis, a graduate engineer at 950 Park Square Building, Boston.

The Marienville Glass Company's plant, Marienville, Pa., which was destroyed by fire early Sunday morning on June 1 with a loss reported as $150,000, will, according to a reported statement by R. R. Underwood, be rebuilt immediately. This plant is affiliated with the Knox Glass Bottle Company of Knox, Pa., and the Oil City Glass Bottle Company, Oil City, Pa.

The Pittsburgh Plate Glass Company, according to unconfirmed reports from Monroe, Mich., is contemplating the establishment of a large project in that town. Work on the million dollar addition to the company's plant at Milwaukee, Wisconsin, it is reported, will be started as soon as plans are completed.

The Pittsburgh Plate Glass Company, according to a statement recently made by W. C. Jerome, president of the (Santa Ana, California) Chamber of Commerce, have given the Chamber assurance that work will begin before the end of this year on the company's proposed new plate glass factory, for which the site has already been secured.

Morgantown and Weston, both West Virginia cities, are making plans to invite the American Flint Glass Workers' Union of the United States and Canada to hold its 1931 convention in that city. This year's convention is taking place at Toronto, Ontario, on June 30, as this edition goes to press.

Hazel-Atlas Glass Company directors at the June meeting unanimously elected William H. Koch a director on the board to succeed the late George W. Hannon. The company is having plans completed for the erection of a new office building at Fifteenth and Jacob Streets, Wheeling, W. Va.

Three senior graduates of the Department of Ceramic Engineering, University of Illinois, Charles C. Westall, John B. Miller and R. M. Hainsfurther, entered the employment of the Pittsburgh Plate Glass Company immediately after graduation in June.

Pittsburgh Plate Glass Companys plant at Kokomo, Ind., has discontinued manufacturing operations for an indefinite period. Until recently about 900 men have been employed there.

Libbey-Owens-Ford Glass Company common stock to the extent of 2,367,052 shares will be listed on the New York Stock Exchange. The common stock of the Libbey-Owens Company has been stricken from the list.

The Imperial Glass Company, Bellaire, O., recently announced the appointment of Harry Cushwa, formerly general sales manager for the United States Glass Company, to a similar position in the Imperial organization.

Clark E. Husted, formerly vice-president and secretary of the Edward Ford Plate Glass Company, was recently named vice-president and assistant secretary of the Libbey-Owens-Ford Glass Company.

The Auburn-Hart-Peterson Glass Company is the name given a recent consolidation reported from Chicago of the Auburn Glass Company, the Hart-Peterson Company, and W. T. Franklin.

The Owens Bottle Works old plant at Glassboro, N. J., which at one time did a very large business, but was eventually closed down, is being dismantled.

The National Plate Glass Company's Ottawa, Ill., plant was closed down in June, putting about 950 men out of employment for an indefinite period.

Recent Deaths

Otto Holdren

Otto Holdren, manager of the Jeannette, Pa., plant of the American Window Glass Company, died suddenly at the age of sixty-five while visiting his old home town, Washington Court House, O., in June.

William H. Bristol

William H. Bristol, president of The Bristol Company, Waterbury, Conn., died suddenly of heart trouble on June 18th.

Coming Meetings

The American Glassware Manufacturers, Inc. and the **National Association of Manufacturers of Pressed and Blown Glassware** will hold their annual meeting at Toronto, Ontario, July 14. The American Flint Glass Workers Union Wage Committees will begin conferences with the manufacturers on July 15. The annual meeting of the latter organization will take place in Toronto on June 30.

The Eastern Division of the National Glass Distributers Association will hold its fall meeting at Atlantic City, September 3-5. The first meeting of the *Western Division* will be held at Chicago, September 10-12.

The Illuminating Engineering Society will hold its 24th annual convention at the Hotel John Marshall in Richmond, Va., October 7-10, 1930.

What the World Wants

Specific Inquiries for American Goods Received in the Department of Commerce, Washington, D. C.

France—45849. Glass factory equipment.

Mexico—45802. Bottles, glass and porcelain, for perfumes and cosmetics.

Canada—45798. Bottles, milk, half pint, 100 gross.

Canada—45799. Glassware, ornamental.

Italy—45833. Glassware, pressed and molded.

Mexico—46092. Mirror-making machinery, including glass beveling and cutting equipment; and mirror frame paste molding machinery.

Mexico—46047. Glass jars for facial creams and cosmetics.

Argentina—46004. Thermometers, mercurial, thermocouple, and others, and pyrometers, glass industry.

Inquiries Received

For further information address THE GLASS INDUSTRY

507. Please send information on glass 1½ inch thick and 10 or 12 inches in diameter suitable for telescope mirrors.

508. Who makes or sells electric mirror-silvering tables?

509. Please put me in touch with owners or users of hot bottle decoration processes.

510. We have heard frequent rumors and have seen some newspaper clippings relative to the use of glass for the sides and roofs of houses. We understand the application has been chiefly in Germany. Can you give us any information on this matter?

511. Please let me know who makes machines for blowing level bulbs, because I want to buy one.

512. Where can we obtain glass vases for use in cemeteries?

Readers Wants and Offers

FACTORY SUPERINTENDENT

FACTORY SUPERINTENDENT, at present employed, desires to make a change for personal reasons. Has had fifteen years' experience in the bottle business and is capable of taking charge of entire factory or any part thereof. Experienced with feeders and Owens machines. For further information write SW-10, c/o THE GLASS INDUSTRY, 24 West 40th Street, New York.

Current Prices of Glass-Making Materials

June 19, 1930

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.46	.46
Hydrochloric (HCl) 20° tanks, per 100 lb		..	1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100 lb.		5.50	..
Sulphuric (H_2SO_4) 66° tank cars	ton	15.50	..
Tartaric	lb.	..	.35½
Alcohol, denatured	gal.	..	.52
Aluminum hydrate (Al $(OH)_3$)	lb.	.04½-.05	.05½-.06
Aluminum oxide (Al_2O_3)	lb	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.21-.22
Ammonia water (NH_4OH) 26° drums	lb.	.03	.03¼
Antimony, metallic (Sb)	lb.	..	.09¾
Antimony oxide (Sb_2O_3)	lb.	..	.09⅝
Antimony sulphide (Sb_2S_3)	lb.	..	.14
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.04½
Barium carbonate ($BaCO_3$), Crude, (Witherite) 90%, 99% through 200 mesh	ton	47.00	..
90% through 100 mesh	ton	44.00	..
Barium hydrate ($Ba(OH)_2$)	lb.	..	.05-.05½
Barium mixture, glassmaker's, f.o.b. St. Louis	ton	25.00	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08
Barium selenite ($BaSeO_3$)	lb.	..	..
Barium sulphate, in bags	ton	..	..
Barium sulphate, glassmaker's, carlots, bulk, f.o.b. shipping point,	ton	15.00-16.00	18.00
Bone ash	carlots, lb.	.06	.06½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	..	.0355-.0425
Crystal	lb.	.028-.033	..
Granulated	lb.	.025-.02	..
Powdered	lb.	.02875-.03375	..
Boric acid (H_3BO_3)	lb.	.0625-.07125	.06-.08125
Refined	lb	.0625-.07125	.07125-.08125
Cadmium sulphide (CdS)—			
Red	lb.	..	.80-1.00
Orange	lb.	..	.80-.90
Yellow	lb.	..	1.20-1.25
Chromium oxide (Cr_2O_3)	lb.	.24	.25
Cobalt oxide (Co_2O_3)			
In bbls.	lb	..	2.00-2.10
In 10 lb. tins	lb	..	2.20
Copper oxide			
Red (Cu_2O)	lb	..	.25
Black (CuO)	lb	..	.23-.27
Black prepared	lb	..	.27
Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith)	lb.	.09	.10-.10½
Artificial or Chemical	lb		.09½
Epsom salts ($MgSO_4$) (imported) Per 100 lb.		..	1.15-1.20
Feldspar—			
100 mesh	ton	12.50-20.00	13.50-22.00
80 mesh	ton	11.00-11.75	14.50
40 mesh	ton	11.00	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	..	.07½-.07¾
Graphite (C)	lb	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb	..	.0450
Black (FeO)	lb.	.04½	..
Kaolin (f.o.b. mine)	ton	9.00	..
English, lump, f.o.b. New York	ton	14.50-25.00	24.50-30.00
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.		
Lead oxide (Pb_3O_4) (red lead)	lb	.079	.09
Litharge (PbO)	lb.	.069	.08
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	10.50	..
Burnt (CaO) ground, in bulk	ton	7.00	..
Burnt, ground, in paper sacks	ton	9.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15-2.25	2.30-2.60
Limestone ($CaCO_3$)		2.00-2.50	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.07-.10½
Manganese 85% (MnO_2)	lb.	.03	.03
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	21.00	23.00-29.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb	.09	.09¼
Ground	lb	11	12
Potassium carbonate—94-96%	lb.	.0555	.0555
Calcined (K_2CO_3) 96-98%	lb.	.06½	.07¼
Hydrated 80-85%	lb.	.05¾	.06¼
Potassium chromate (K_2CrO_4)	lb.	..	.23-.32
Potassium hydrate (KOH) (caustic potash)	lb.	.07⅛	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.06½-.06¾
Potassium permanganate ($KMnO_4$)	lb.	.16	.17
Powdered blue	lb.	..	24-.26
Rochelle salts, bbls.	lb.	..	.22
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb	..	1.80-1.90
Silver nitrate (AgNO.)	(100 oz.) per oz.	..	.27½-.30¾
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½	
In barrels	Per 100 lb.	1.55-1.57½	1.90-2.00
In bags	Per 100 lb.	1.37½-1.40	1.72½
Spot orders.. .025 per 100 lbs. higher			
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.07	.07½
Sodium hydrate (NaOH) (caustic soda) Solid	Per 100 lb.	2.95	..
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03¾	.04½
95 per cent.	Per 100 lb.	2.10	2.25
Sodium selenite (Na_2SeO_3)	lb.	..	2.00
Sodium fluosilicate (Na_2SiF_6)	lb.	.05	.05½
Sodium uranate (Na_2UO_4) Yellow or Orange	lb	..	1.50-1.55
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.39	.37½
Tin oxide (SnO_2) in bbls.	lb.	..	.36-.40
Uranium oxide (UO_2) (black, 96% U_3O_8)			
100 lb. lots, Black	lb.	..	2.75
Yellow	lb.	..	1.50
Zinc oxide (ZnO)	lb.	.03½	.12
American process, Bags	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to May 27, 1930

	April 1929 Quantity	April 1929 Value	April 1930 Quantity	April 1930 Value	Four Months Ending April 1929 Quantity	Four Months Ending April 1929 Value	Four Months Ending April 1930 Quantity	Four Months Ending April 1930 Value
Glass and glass products (Total)	.....	$948,819	.....	$839,766	.....	$3,672,836	.....	$3,140,933
Plate and window glass—								
Window glass, common, box 50 sq. ft.	3,493	15,197	1,891	8,684	7,495	40,742	6,426	33,601
Plate glass, unsilvered, sq. ft.	172,567	53,372	430,645	127,349	779,400	269,461	1,062,200	339,577
Other window and plate glass lbs.	455,515	44,402	432,280	41,358	1,703,185	174,205	1,817,937	172,023
Glass containers (bottles, vials and jars)	.....	299,882	.....	249,705	.....	1,118,021	.....	943,904
Table glassware, plain	.....	161,762	.....	117,460	.....	530,120	.....	439,063
Table and other glassware, cut or engraved	.....	14,923	.....	9,308	.....	38,973	.....	34,940
Lamp chimneys and lantern globes lbs.	130,597	26,597	105,147	19,926	538,206	116,023	380,837	74,174
Globes and shades for lighting fixtures lbs.	171,080	65,385	153,682	50,654	695,484	258,934	597,519	219,364
Chemical glassware lbs.	16,250	18,266	16,463	17,044	79,313	75,040	78,065	72,289
Electrical glassware, except for lighting lbs.	643,726	46,584	717,948	30,683	2,493,000	183,352	1,951,756	123,592
Other glassware	.....	202,449	.....	167,595	.....	867,965	.....	688,406

IMPORTS

Corrected to May 27, 1930

Glass and glass products	.....	993,470	.....	751,625	.....	4,151,811	.....	3,180,006
Cylinder, crown and sheet—								
Unpolished, not bent, obscured, beveled, etc.—								
Weighing less than 80 pounds per case dut. lb.	3,122,078	75,536	552,707	24,243	12,881,858	337,733	2,886,970	109,650
Weighing 80 pounds or over per case dut. lb.	2,685,206	98,665	660,007	26,667	11,171,551	400,341	5,507,566	213,792
Polished and bent, obscured, beveled, colored, etc., unpolished and polished, and all silvered dut.	.....	54,522	.....	28,621	.....	205,840	.....	136,660
Plate glass—								
Polished, unsilvered dut. sq. ft	446,853	118,169	473,461	97,770	3,860,696	852,110	2,208,301	465,776
Other dut. sq. ft.	177,866	30,412	175,547	25,270	482,784	93,324	417,520	97,071
Bottles, vials, jars, demijohns and carboys, molded or pressed dut.	.....	20,081	.....	146,529	.....	94,584	.....	513,666
Table and kitchen utensils dut.	.....	25,929	.....	10,297	.....	77,521	.....	58,194
Glassware, cut or decorated dut.	.....	200,398	.....	146,480	.....	845,454	.....	588,830
Blown, glassware, n. e. s.—								
Bottles, ornaments, gauge glasses and other n. e. s. dut.	.....	115,573	.....	27,396	.....	260,683	.....	128,694
Bulbs for electric lamps dut. No. 1	1,459,932	13,706	1,695,963	14,473	7,078,015	58,671	5,467,892	46,958
Chimneys, globes, shades, prisms and other illuminating glassware dut.	.....	76,006	.....	53,499	.....	324,336	.....	246,573
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	53,890	.....	46,988	.....	176,694	.....	192,977
Other glassware dut.	.....	110,583	.....	103,392	.....	424,520	.....	381,165